

# FEDERAL GEOGRAPHIC INFORMATION SYSTEMS MARKET

1991 - 1996

INPUT

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**Federal Information Systems and Services  
Program (FISSP)**

***Federal Geographic Information Systems  
Market, 1991-1996***

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## Abstract

INPUT estimates that the federal geographic information systems (GIS) market will grow from \$162 million in 1991 to \$438 million in 1996, at a compound annual growth rate of 22%.

This unusually high growth rate results from a low starting base, widespread agency use, state and local government involvement, and OMB interest. INPUT expects this growth rate to result in increased sales opportunities, especially for companies offering multifeatured solutions.

Presently, no vendor dominates federal GIS activities. Rather, numerous vendors provide equipment, software, and related professional services in a mix-and-match mode. To increase market penetration, vendors need to develop multiple hardware/software offerings and establish strategic teaming alliances. To the extent that they can establish special capability niches, they will increase their appeal as preferred contractors and teaming partners.

The report contains 104 pages and 30 exhibits.



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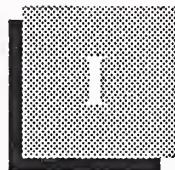
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## Introduction

*Federal Geographic Information Systems Market* (GIS) is a new INPUT report. It has been prepared as a result of the growing importance of GIS in federal IRM applications, as well as a growing interest among agency and contractor executives. GIS applications now span a wide range of federal agencies, covering everything from law enforcement to photographic analysis to battle planning.

More than a dozen federal agencies participate in the Federal Geographic Data Committee (FGDC), an interagency coordinating committee. The FGDC, along with OMB Circular A-16, "Coordination of Surveying, Mapping, and Related Spatial Data," have fostered more government-wide understanding of GIS. OMB, in particular, has stressed the importance of GIS standards to facilitate the sharing of spatial data between the producers and the users.

*Federal Geographic Information Systems Market* is presented in the issue paper format, which INPUT first used in 1990's federal program. It covers only the market issues and agency surveys, without surveying vendors for their thoughts. The report is also shorter than regular INPUT reports. For these reasons, it is considered an issue paper.

This paper was prepared as part of INPUT's Federal Information Systems and Services Program (FISSP). Market analyses issued through this program are designed to assist INPUT's U.S. industrial clients in planning how to satisfy future federal government needs for computer-based information systems and services. The report's findings are based on research and analysis of several sources, including:

- Interviews with federal agency GIS users and managers
- Interviews with federal oversight agency representatives
- INPUT's Procurement Analysis Reports (PARs)
- Federal guidelines and reports on GIS
- Various secondary research sources

**A****Scope**

The material in this document provides a specialized supplement to previous INPUT reports on various subjects, including software, professional services, systems integration, and computer equipment. It is intended to give INPUT's clients a clear description of the current status and future trends of the federal GIS market. It also identifies some of the key vendors in this market.

This report focuses on the federal government's approach to GIS, from both the user's and the policy official's standpoint. Through an examination of future trends, this report also presents a five-year forecast of the federal GIS. This forecast takes into account both the technology advances, which are enhancing this market, and the budget constraints, which are holding it back.

**B****Methodology**

INPUT used several sources and methods to develop this report. These included surveys of agency officials, analysis of planned federal procurements involving GIS, analysis of federal guidelines and directives involving GIS, and collection and synthesis of available secondary research.

INPUT developed a questionnaire for agency GIS managers and users (see Appendix E). It addressed agency applications (environment), buying intentions, and perceptions of federal GIS. This data assists in forecast development as well as providing anecdotal characterizations of the federal GIS market.

As in other reports, INPUT reviewed agency long-range plans and the PARs to develop details of agency activities. Many PARs cover programs or initiatives that do not appear in the agency budget submissions. These sources permit a better understanding of market direction.

**C****Report Organization**

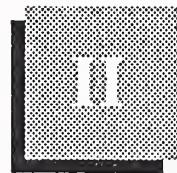
Besides the introduction and appendixes, this report consists of four chapters.

- Chapter II presents an executive overview describing the major points and findings in the report.
- Chapter III presents a market analysis and forecast, and also includes a discussion of leading vendors.
- Chapter IV addresses the main issues surrounding federal GIS and also reports on the results of agency surveys.

- Chapter V provides a sample of GIS opportunities in the federal market.

In addition, various appendices are included.





## Executive Overview

### A

#### GIS Definition

In approaching the federal market for Geographic Information Systems (GIS), it is important to develop an appropriate definition. INPUT's definition, for the purposes of this report, comes from the Federal Interagency Coordinating Committee on Digital Cartography (FICCDC).

A GIS is a computer hardware and software system designed to collect, manage, manipulate, analyze, and display spatially referenced data. Exhibit II-1 summarizes these elements.

---

#### EXHIBIT II-1

#### GIS Definition

- Hardware and software system designed to:
  - Collect
  - Manipulate
  - Manage
  - Analyze
  - Display

Spatially referenced data

A GIS manipulates attribute data (usually in an associated data base) as well as graphic data. This latter information may be in vector (line) or raster (grid or image) form. A GIS may process cartographic and geographic data, including earth science, biological science, ecological, infrastructure, utility, urban, demographic, or socioeconomic data.

**B****Federal Market Pressures**

The federal GIS market is changing and growing in interesting ways. Exhibit II-2 lists factors driving this market.

**EXHIBIT II-2****Federal Market Pressures**

- New, diverse technologies
- OMB support
  - Circular A-16 revision
  - FICCDC activities
- State/local government interest
- Widespread agency involvement

Various agencies are applying new, diverse technologies to implementation of GIS. For example, the Federal Emergency Management Agency and NASA, through their Light Detection and Ranging (LIDAR) experiment, are investigating the feasibility of collecting precise digital topographic data from an airborne platform. The U.S. Geological Survey is using digital elevation data and imagery to develop a micro-based GIS. The FICCDC is promoting a Spatial Data Transfer Standard to facilitate compatibility among varying technologies. The Centers for Disease Control uses statistical modeling of complex spatial relationships from diverse data bases. As agencies refine the various technologies and bring them together, GIS will become more common throughout the government.

In revising OMB Circular A-16, OMB explicitly defined GIS responsibilities for various government agencies. This definition, plus the coordination and standardization activities of the FICCDC, is increasing interest in GIS throughout the government.

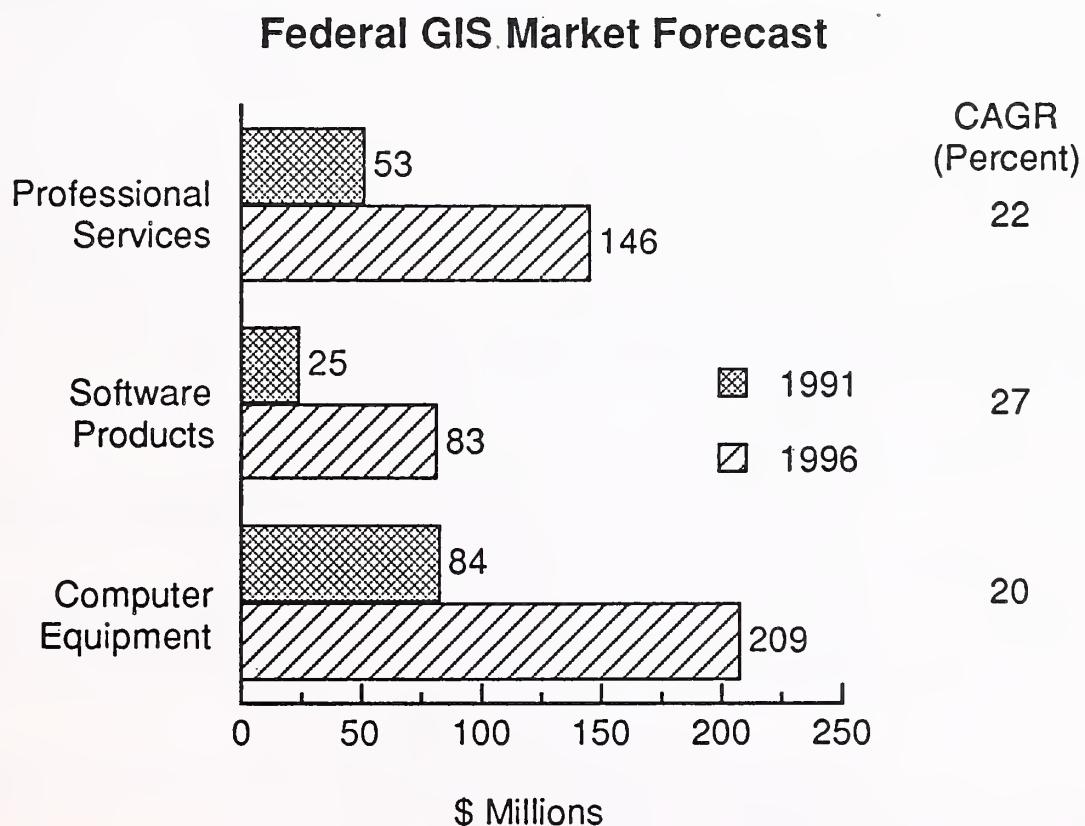
In many cases, state and local governments are making effective use of GIS in carrying out their missions. These activities have increased federal interest in the subject, especially among agencies, such as Agriculture and Interior, that work closely with the states. However, agency involvement is considerably more widespread. In a survey of 110 agencies, the FICCDC reported that 95 were using or planned to use GIS. Although most of the GIS projects reported were small, 29 agencies identified projects exceeding \$1 million.

## C

## Market Forecast

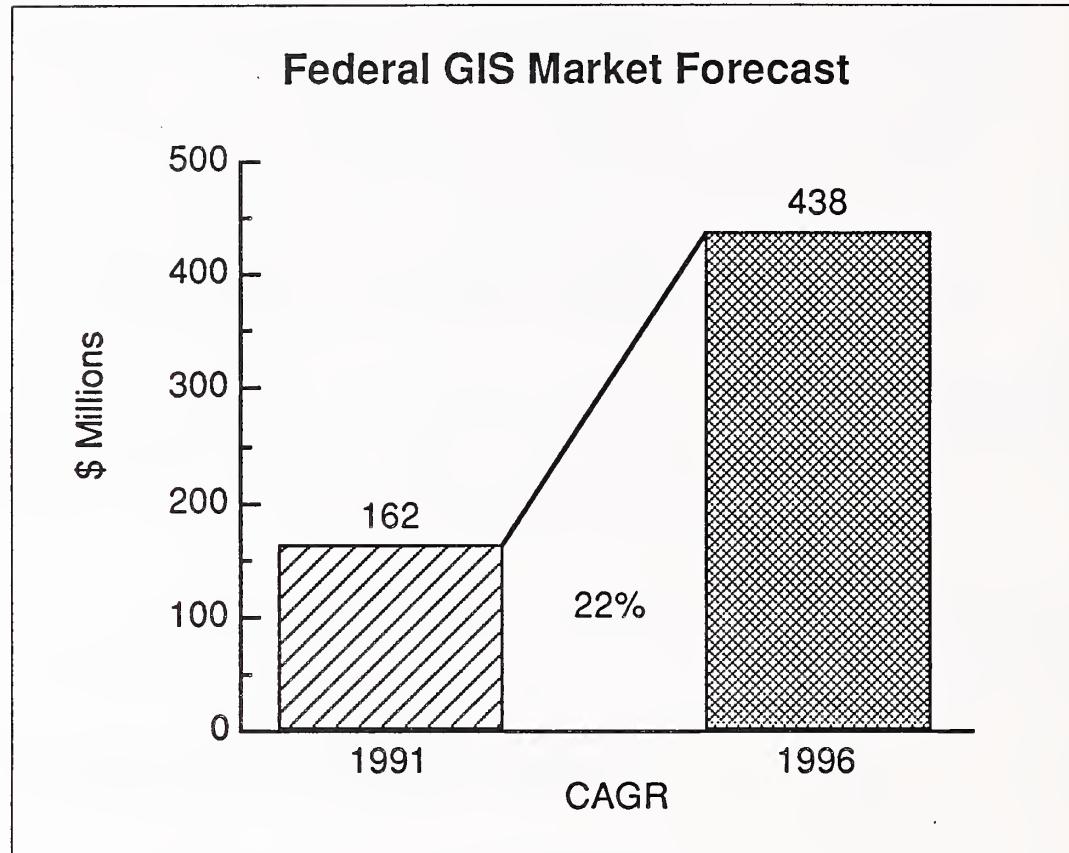
The federal GIS market will grow from \$162 million in FY 1991 to \$438 million in FY 1996, which is a compound annual growth rate (CAGR) of 22%. Exhibit II-3 presents a breakout of this forecast into its various components.

## EXHIBIT II-3A



All three market components (professional services, software products, and computer equipment) will show high growth rates. However, INPUT expects the software products market, at a CAGR of 27%, to grow fastest. Growth will occur as a result of the growing availability and functionality of GIS software.

## EXHIBIT II-3B



The high growth rate overall results from the following factors:

- A low starting base
- Widespread agency use
- State and local government involvement
- OMB interest

INPUT expects this growth rate to result in increased sales opportunities.

**D****Software Vendors**

Currently, the federal GIS market is highly fragmented among vendors. No one dominates the market. Exhibit II-4 lists software vendors that are active in the federal GIS market.

- ESRI supports GIS applications at the Geological Survey and Census Bureau.
- Intergraph provides GIS software in a modular form to various agencies.
- Synercom Technology designs, develops, and supports spatial information management systems.

## EXHIBIT II-4

## GIS Software Vendors

- ESRI (Environmental Systems Research Institute)
- Intergraph
- Synercom Technology, Inc.
- GeoVision
- Mapping Information Systems
- Caliper
- Terralogics
- Geographic Data Technology, Inc.
- Strategic Mapping, Inc.

- GeoVision Corporation provides GIS software for the input, management, processing, and analysis of geographically referenced data.
- Mapping Information Systems provides mapping information that interfaces with Microsoft Windows.
- Caliper Corporation provides GIS software to support a data base of latitude and longitude values.
- Terralogics provides application development tools to facilitate the linking of applications to a GIS.
- Geographic Data Technology provides software that extracts 1990 census information and allows users to view changes in district statistics.
- Strategic Mapping also provides software that operates on Census data. Strategic Mapping's Atlas GIS software provides an analysis and display of geographic relationships.

**E****Agency Selection Criteria**

INPUT asked federal agency officials to rate the importance of various selection criteria. Exhibit II-5 summarizes the results.

**EXHIBIT II-5****GIS Selection Criteria**

Criteria	Mean Importance
Software Features	4.5
Equipment Reliability	4.4
Ease of Implementation	4.3
Vendor's Support Reputation	4.0
Product Price	3.5
Vendor's Federal Experience	2.3

Scale: 1 through 5; 1 = least important  
5 = most important

Vendors seeking to enter this market or expand their market share need to keep these factors in mind. Vendors providing reliable equipment with easy-to-use, feature-filled software will likely capture the bulk of the business. Price and federal experience do not appear to be as important to the federal GIS market as they are in other areas.

**F****Recommendations**

With the growth in federal GIS activities, many new vendors are entering the market. Vendors must, therefore, establish special niches or capabilities that enable them to provide superior solutions. This and other recommendations are summarized in Exhibit II-6.

## EXHIBIT II-6

## Recommendations

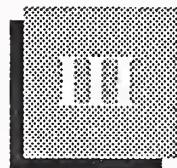
- Establish special capability niches
- Develop multiple hardware/software offerings
- Increase technology and agency understanding
- Establish strategic teaming alliances
- Organize for multi-government sales

To accommodate the diverse federal market, software vendors need to provide their software on multiple hardware platforms. Similarly, in order to increase market penetration, hardware vendors need to encourage software development.

To develop effective and cost-effective system solutions, integrators need to improve their understanding of technology and agency needs. All classes of vendors need to establish strategic alliances in order to respond to agency solicitations.

Finally, because much federal GIS activity is tied to state and local governments, vendors need to organize joint marketing and sales efforts. Frequently, a state sale will lead to a federal opportunity or vice versa.





## Market Analysis and Forecast

This chapter discusses INPUT's market forecast, vendor market participation, and factors impacting market conditions. It also offers recommendations for vendors currently participating in this market or considering entry. For this report, a geographic information system (GIS) is defined as a computer hardware and software system designed to collect, manage, manipulate, analyze, and display spatially referenced data. A GIS manipulates attribute data (usually in an associated data base) as well as graphic data, which may be in vector (line) or raster (grid or image) form. A GIS may process cartographic and geographic data—including earth science, biological science, ecological, infrastructure, utility, urban, demographic, or socioeconomic data.

The above definition is consistent with that developed by the Federal Interagency Coordinating Committee on Digital Cartography (FICCDC). OMB established the FICCDC to coordinate and report on federal agencies' digital cartographic data activities.

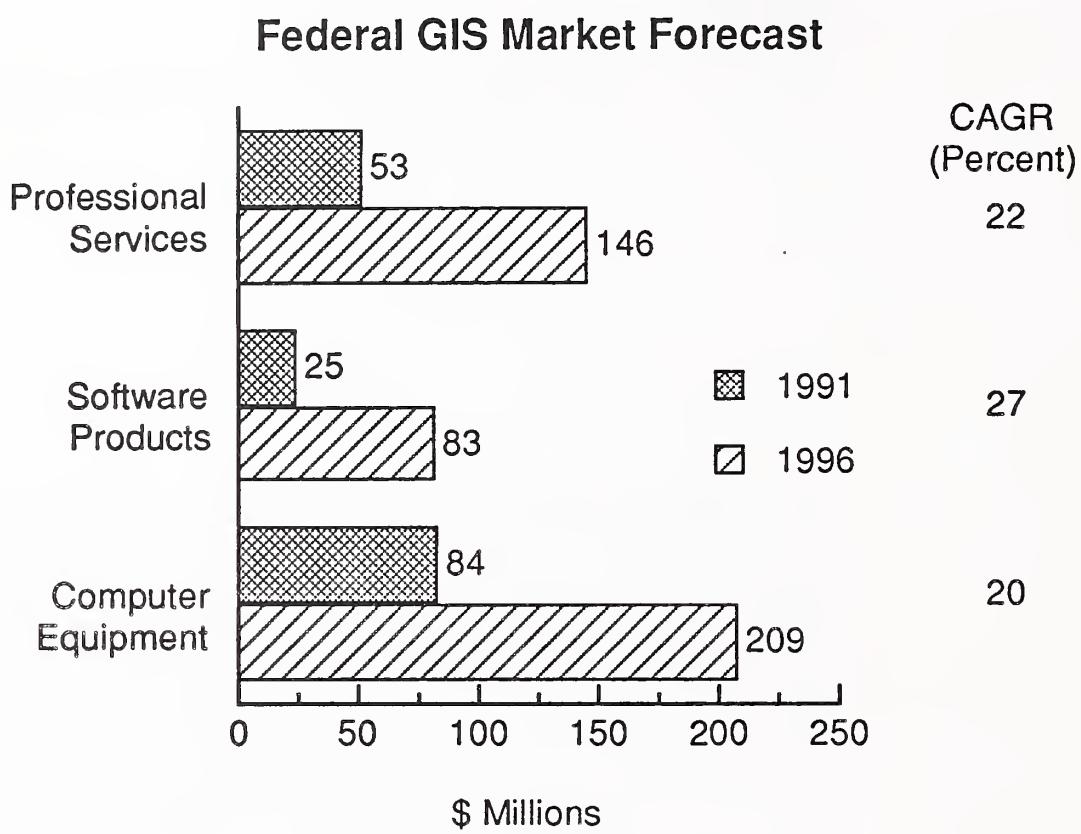
### A

#### Market Forecast

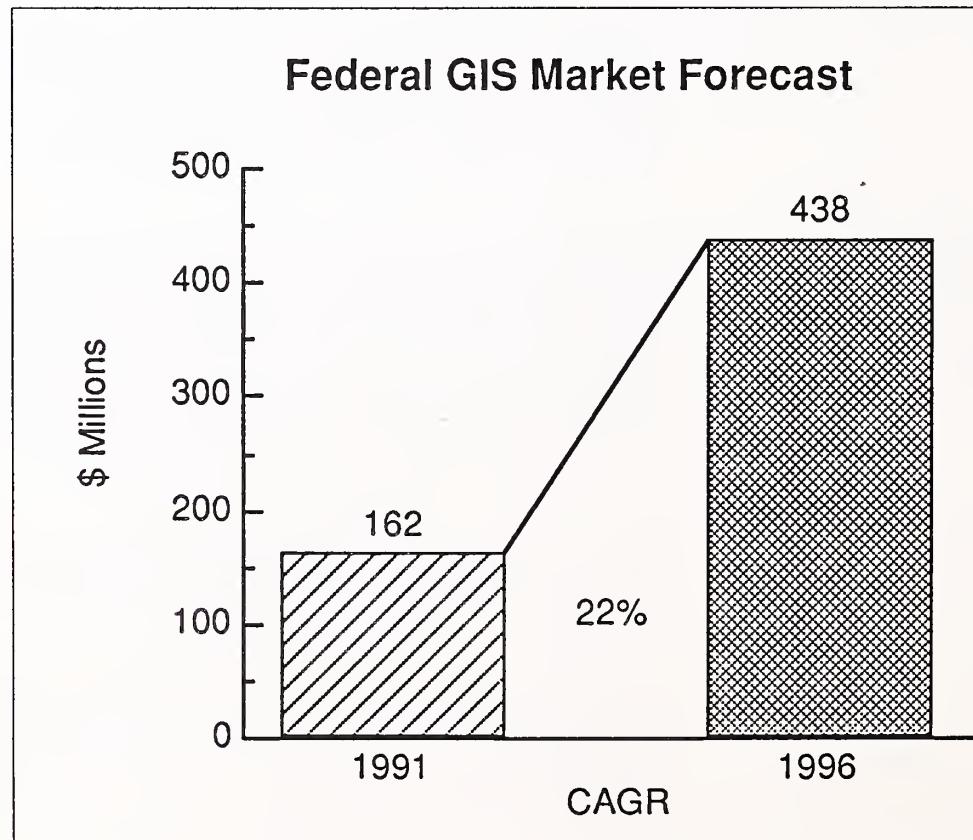
Unlike most other market segments that INPUT tracks (where growth rates rarely exceed 10%), the federal GIS market will grow at a compound annual rate of 22% over the next five years. Exhibit III-1 shows the market forecast, broken into three categories: professional services, software products, and computer equipment. Exhibit III-2 summarizes several factors that account for this unusually high growth rate.

- The GIS market is starting out from a relatively low base (estimated at \$162 million in FY 1991). Thus, increases of modest dollar amounts show up as a high percentage.
- In a recent FICCDC study, 95 agencies stated that they used or planned to use GIS. This is a surprise in light of the fact that the technology has limited application in many areas and virtually no application in many others.

## EXHIBIT III-1A



## EXHIBIT III-1B



## EXHIBIT III-2

## Factors Promoting the Market

- Initial low base
- Widening agency participation
- State and local government activities
- Revised OMB Circular A-16
- FICCDC coordination activities

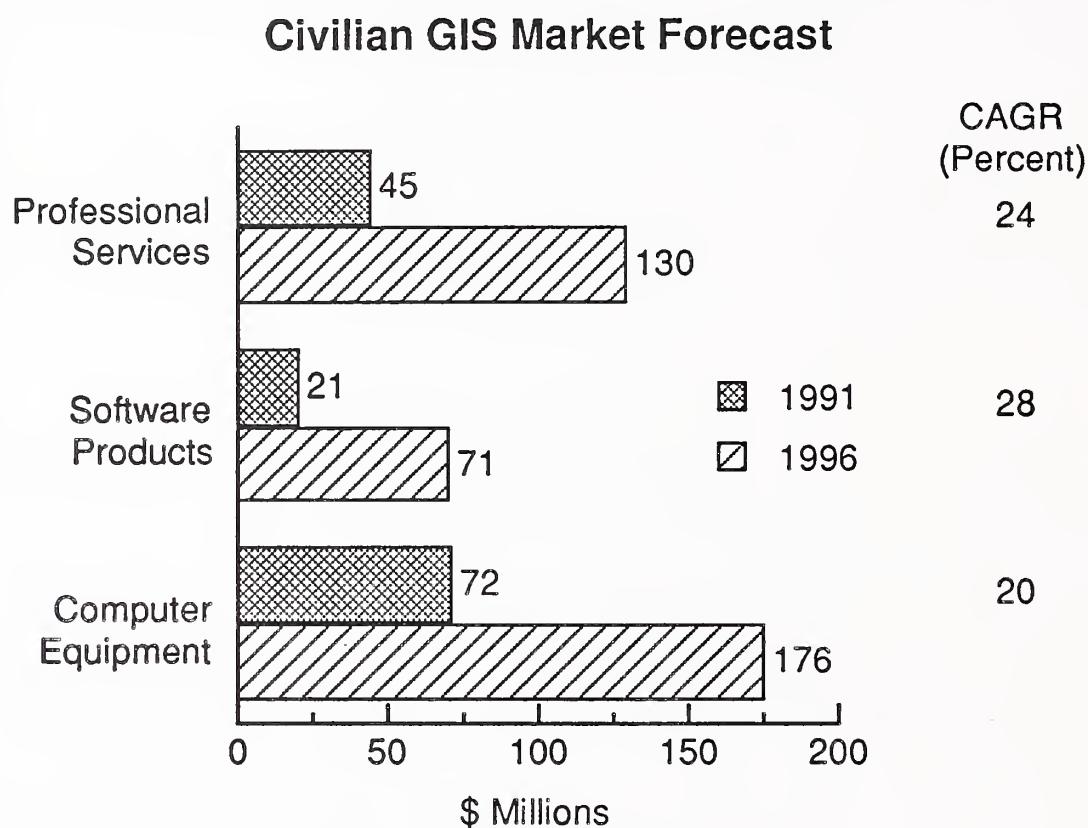
- It has been estimated that state and local government spending for GIS nearly equals federal spending. In many cases, state and local applications are leading federal agencies into more extensive GIS activities.
- The FICCDC, in 1989, revised OMB Circular A-16 on coordination of surveying, mapping, and related spatial data. It now provides for expanded coordination of spatial data activities, as well as a structure and support mechanism to maintain these coordination activities.
- The FICCDC also assists federal managers and technical specialists in evaluating, designing, and procuring GIS. This assistance effectively promotes the introduction and use of GIS among federal agencies.

**B****Civilian Agency Forecast**

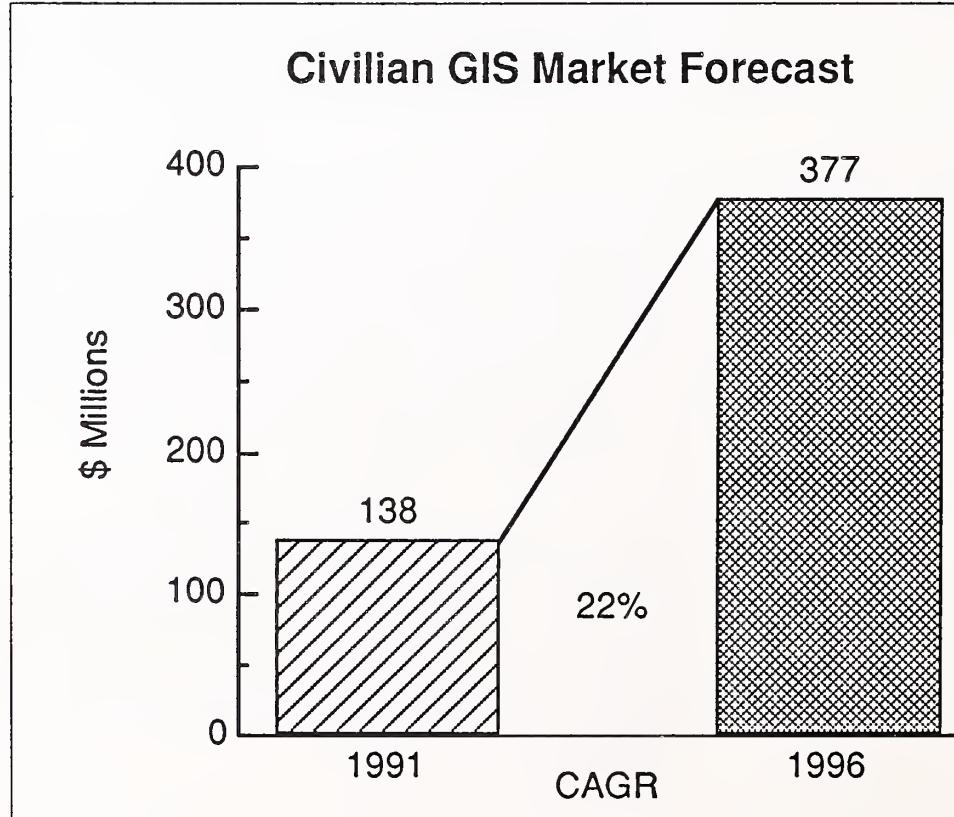
As shown in Exhibit III-3, civilian agencies make up nearly 85% of the federal GIS market. This civilian side of GIS will grow from \$138 million in FY 1991 to \$377 million in FY 1996, at a compound annual growth rate of 22%. The Energy and Interior Departments appear to be the most active, with some activity coming from Agriculture, Commerce, Transportation, NASA, and EPA. Exhibit III-4 lists some of the key civilian GIS activities.

The Energy Department is establishing a National Waste Information Network (NWIN) as part of its Hazardous Waste Removal Actions Program. Energy will use GIS in pinpointing hazardous waste locations. In a more well-known program, Energy is establishing the Licensing Support System (LSS) as an encyclopedia on nuclear waste. The LSS will use GIS to assist in the siting and tracking of proposed waste locations.

## EXHIBIT III-3A



## EXHIBIT III-3B



## EXHIBIT III-4

## Civilian GIS Activities

Energy	- National waste information network - Licensing support system
Interior	- Mapping output systems - BLM ADP modernization - EROS data center
Transportation	- Real-time weather processing
NASA	- Earth observing system
EPA	- GIS workstations
Agriculture	- Project 615
Commerce	- AWIPS-90

The Interior Department is establishing Output Systems for the National Mapping Division. This program will provide GIS information in a turnkey platform to interested personnel. The Bureau of Land Management's ADP Modernization Program, a widely known and discussed project, will use GIS to implement a total Land Information System. The Geological Survey will establish the Earth Resources Observation System (EROS) Data Center to process photographs or images. Finally, the Geological Survey recently introduced a new initiative on GIS software to run on various brands of workstation equipment.

Some other civilian agency GIS activities are summarized below:

- The Transportation Department is establishing the Real-Time Weather Processor Program to automate weather data analysis for air traffic controllers.
- Through its Earth Observing System, NASA seeks to obtain a scientific understanding of the entire Earth.

- The Environmental Protection Agency has developed a GIS to acquire 600 workstations—as well as digitizers, printers, plotters, and other peripherals. In addition, EPA has reported other GIS applications:
  - Geocoding accuracy program at headquarters and Kansas City
  - Waste management initiative at the Atlanta Regional Office
  - Ecological risk evaluation at the Dallas Regional Office
  - Superfund site discovery effort at the Seattle Regional Office
- Through its Project 615, the Agriculture Department is expanding its Forest Level Information Processing Systems.
- At Commerce's National Weather Service, the AWIPS-90 Program will provide 1,000 scientific workstations to distribute a large array of observational data, satellite imagery, and radar information.

INPUT expects new civilian agency programs that build on the GIS science and capabilities already developed.

## C

### Defense Agency Forecast

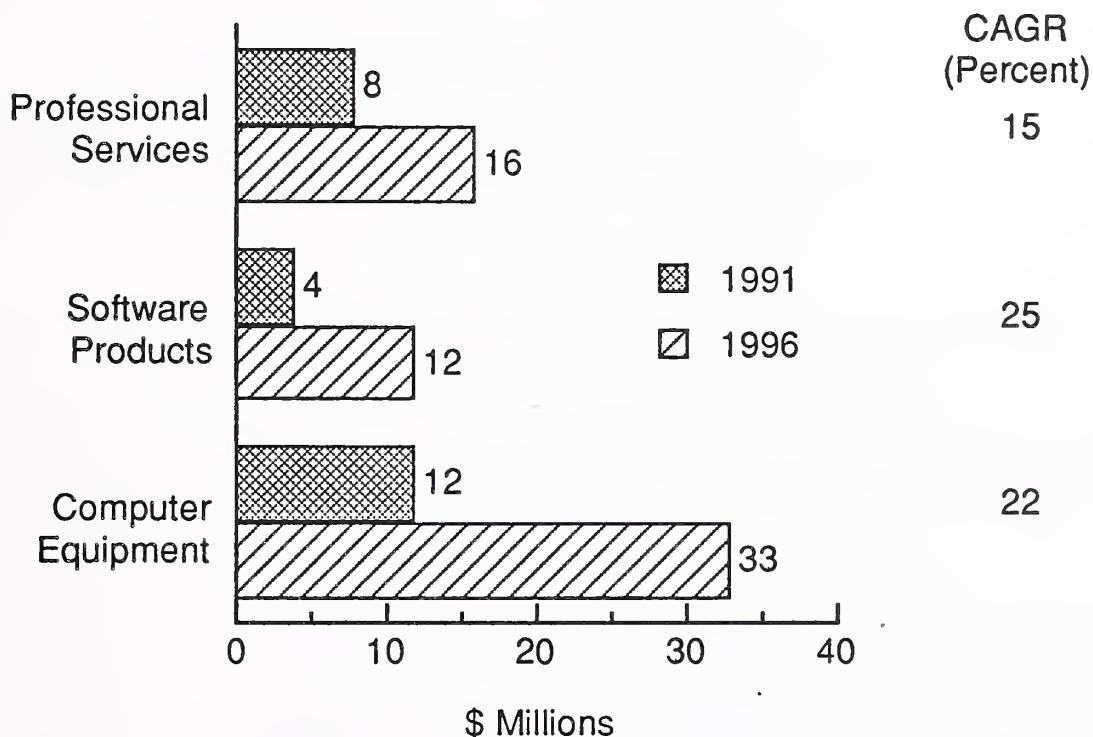
As shown in Exhibit III-5, the unclassified defense GIS market is considerably smaller than the civilian market. INPUT expects it to grow from \$24 million in FY 1991 to \$61 million in FY 1996, at a compound annual growth rate of 21%. The following are representative samples of GIS programs:

- In 1990, the Air Force's Environmental Technical Application Center acquired new Unisys equipment to use in building a climatological data base of historical weather information.
- Under its Advanced Computer Flight Plan, the Air Force is acquiring software development for compilation of a meteorological data base.
- The Army Electronic Proving Ground is acquiring support software and interoperability test tools for C4I systems.
- During the recent Gulf war, the Army upgraded its Maneuver Control System, a flat-map capability for updating the war picture.

INPUT expects defense agencies to make increased use of GIS for war gaming and battle management activities, although these applications may not be given publicity due to their national security sensitivity.

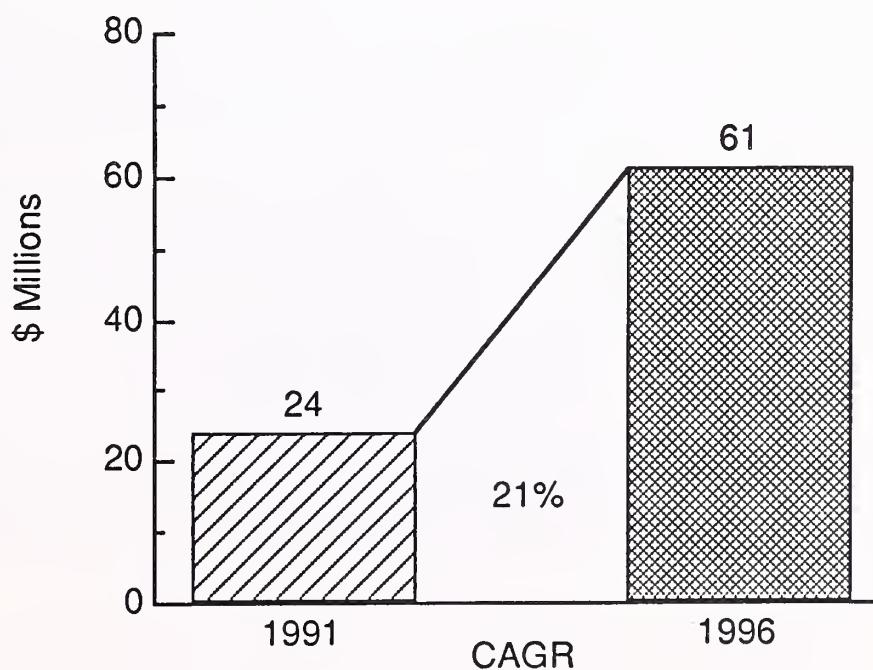
## EXHIBIT III-5A

## Defense GIS Market Forecast



## EXHIBIT III-5B

## Defense GIS Market Forecast



**D****Software Vendors**

Exhibit III-6 presents a list of some of the leading software vendors providing GIS software and complete systems.

**EXHIBIT III-6****GIS Software Vendors**

- ESRI (Environmental Systems Research Institute)
- Intergraph
- Synercom Technology, Inc.
- GeoVision
- Mapping Information Systems
- Caliper
- Terralogics
- Geographic Data Technology, Inc.
- Strategic Mapping, Inc.

The capabilities of these vendors vary. They range from vendors providing software on only one platform to those who cover the full range of platforms and associated services for the development of the GIS.

- Environmental Systems Research Institute (ESRI) offers the ARC/INFO family of GIS products, which allows users to capture maps, edit information captured, build the attribute tables used to integrate thematic data with map features, and create custom menu-based operations. ARC/INFO can be installed on mainframes, microcomputers, PCs, and workstations. ARC/INFO has the ability to read many public and commercial data sets. For example, ARC/INFO can read the U.S. Geological Survey's Digital Line Graphs, the Census Bureau's TIGER and DIME data bases, and CAD and Raster data.

- Intergraph (Huntsville, AL) supplies mapping and GIS technology to the government in a modular form that facilitates creation of a complete geographical information system. With the modular system, users customize Intergraph components to their requirements. The software at the base of the system is MGE/SX. Other available options include:
  - Relational Interface System (RIS) uses ANSI-standard SQL to provide a direct link to available data base management systems.
  - Land Records Management (LRM) software provides an automated system for the management of geographic/land information.
  - Exploration and Production Section Evaluation and Correlation Tools (EP/SECT) enables geologists to generate, interpret, and manage two- and three-dimensional cross-section displays and correlation panels.
  - Exploration and Production Geologic Interactive Mapping System (EP/GIMS) provides comprehensive facilities to generate, interpret, and manage two- and three-dimensional subsurface maps, including structure, thickness, and distribution maps.
- Synercom Technology, Inc. designs, develops, and supports spatial information management systems for major government and commercial organizations worldwide. INFORMAP spatial information system integrates spatial, graphic, and attribute data in a single data base designed to handle large amounts of data. The INFORMASTER module manages INFORMAP data bases in a distributed data base and processing environment using DEC's DECnet networking architecture. Software options are available to address unique refinements.
- GeoVision Corporation specializes in the development and marketing of specialized GIS software for the input, management, processing, and analysis of geographically referenced information. GeoVision's AMS/GIS software offers a distributed approach to ensure continued system growth while eliminating information processing bottlenecks. AMS/GIS operates on various VMS and UNIX platforms, including SUN Microsystems, DEC, and IBM hardware platforms. Special features of AMS/GIS include a spatial indexing system that views the data as a single, continuous map; a topological structure that maintains contiguity and continuity relationships among linear and polygonal elements; and an embedded copy of the ORACLE data base system.
- Mapping Information System's MapInfo GIS product takes advantage of Microsoft Window's 3.0 graphical interface. The program focuses on maps, but can manipulate any specially linked information.

## EXHIBIT III-7

### Hardware Vendors Active in the GIS Market

- IBM
- Stardent
- Silicon Graphics
- DEC
- Sun Microsystems

information requirements, develop implementation strategies, and provide overall project management and implementation expertise for the development of geographic information systems. Utility Graphics plans to trade with UGS Consulting under the agreement with IBM.

IBM invested earlier (October 1989) in the GIS market when it acquired a portion of Geographic Systems Corporation of Green Bay, WI.

Silicon Graphics, Inc., Mountain View, CA, recently announced the ability to port ESRI's ARC/INFO software to the Silicon Graphics IRIS 4D family of workstations. Silicon Graphics is a major supplier of workstations to the geoscientific community. The IRIS workstation incorporates visual processing—the ability to visualize and interact with the data in color, motion, and three dimensions. The GIS strategy of Silicon Graphics is to motivate customers to incorporate visualization into their geographic information systems.

Stardent of Newton, MA is seeking to differentiate itself from other vendors of imaging hardware with a less expensive version of the Tital graphics supercomputer, the Stiletto. The company is developing a plan with Planning Research Corporation of McLean, VA for the NOAA's Advanced Weather Interactive Processing System. Stardent is hoping to be on the winning team with this plan.

DEC and SUN are actively working with the GIS software firms to market complete systems, as shown by recent bids by these firms.

- Caliper Corporation offers a GisPlus Geographic Information System geared toward the expert with strict geocoding (the assignment of latitude and longitude values to a point) of data bases. GisPlus will accept TIGER files via a special utility in the software. GisPlus also offers a versatile mapping feature.
- TerraView (from Terralogics, Nashua, NH) is an object-oriented application development tool that links applications to a geographic information system. TerraView can operate within existing programs, includes hooks to data bases, and handles maps and data as objects independent of hardware platforms. Terralogics has recently added selective polygon access to TerraView. TerraView is written in C and is compatible with X Windows. Supported platforms include VMS, Ultrix, UNIX System V, and DOS.
- Geographic Data Technology, Inc. (Lyme, NH) offers GeoDistrict software, which incorporates information extracted from 1990 TIGER census information to the census block level. The spatial spreadsheet technology allows users to develop graphic plans on the maps, make changes, and immediately view changes in district statistics at the bottom of the screen. GeoDistrict runs on IBM PC, PS/2s, and compatibles.
- Atlas GIS from Strategic Mapping, Inc. provides an analysis and display of geographic relationships. Atlas GIS offers pop-up menus and windowing to create a simplified user interface. Atlas uses the Census Bureau's Topologically Integrated Geographic Encoding and Reference (TIGER) files to match any address with the latitude/longitude coordinates and attach data to those points. The geocoded data is accessed through a pop-up data window or used to create thematic maps. Atlas GIS runs on IBM PCs, PS/2s, and compatibles.

**E****Hardware Vendors**

Many of the leading hardware vendors have become active in the GIS market; see Exhibit III-7. Some vendors have been in the market via teaming with and supporting the software vendors in the marketing of geographic information systems. Through the internal development of GIS software or the acquisition or investment in software firms, a few vendors, such as IBM, have become active in the acquisition of GIS capabilities.

IBM has been buying into small start-up GIS firms to gain expertise in this area, the most recent acquisition being Utility Graphics Consultants, Inc. of Englewood, CO. UGS Consulting will provide executive and technical management consulting, offer assistance in defining strategic

## F

## Leading Professional Services/SI Vendors

Many of the professional service and systems integration firms have been active in, or are testing the feasibility of entering, the federal and commercial GIS markets. Exhibit III-8 presents a list of several leading professional services vendors in the GIS market.

## EXHIBIT III-8

### Leading Professional Services Firms in the GIS Market

- EDS
- Computer Sciences Corporation
- Andersen Consulting

EDS has been partnering with other GIS companies that specialize in various market niches. Part of EDS' strategy includes the building of a master data base of information on people and places. The vertical markets targeted for the use of this information include government, transportation, insurance, banking, retail, energy, and utilities. Under development is the Facilities Land-based Automated Mapping Environment (FLAME) for Atlanta, GA. The system serves as a test bed for a future commercial system.

## G

## Recommendations

Although federal purchases of GIS products and services will increase sharply, many new vendors are entering the market. To increase market penetration, vendors need to establish special niches or capabilities that enable them to provide superior solutions. A firm will succeed to the extent that it can distinguish its product and services from competitors'. With much of the technology relatively new, potential agency customers are encountering many different offerings. This and other recommendations are summarized in Exhibit III-9.

- Since federal agencies want to install GIS software on multiple hardware platforms, software vendors need to provide these capabilities. If the vendors concentrate on only one or two platforms, they risk being excluded from large portions of the federal market.

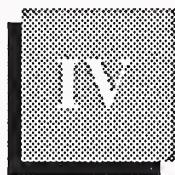
## EXHIBIT III-9

## Recommendations

- Establish special capability niches
- Develop multiple hardware/software offerings
- Increase technology and agency understanding
- Establish strategic teaming alliances
- Organize for multi-government sales

- Conversely, hardware vendors need to encourage GIS software development on their platforms. This will permit application of the hardware to a wider variety of agency needs, in both turnkey and systems integration modes.
- To support assembly of the most cost-effective suite of hardware and software to meet agency needs, integrators need to improve understanding of the technology and the agency needs.
- Since few, if any, vendors can provide complete solutions, strategic teaming alliances appear essential to participation in more agency solicitations.
- Finally, because much federal GIS activity is tied in with state and local governments, vendors need to organize for joint marketing and sales efforts. Frequently a state sale will lead to a federal opportunity, or vice versa.





## Agency Issues

This chapter covers the results of agency surveys completed by INPUT and other related geographic information systems issues. Where applicable, information is supplemented by the Federal Interagency Coordinating Committee on Digital Cartography (FICCDC) study *A Summary of GIS Use in the Federal Government*.

### A

#### Existing Federal GIS Applications

##### 1. Current Applications

The use of geographic information systems (GIS) in federal government agencies is becoming more widespread and showing increasing complexity. Eighty-six percent of the agencies surveyed by the Federal Interagency Coordinating Committee on Digital Cartography (FICCDC) reported that they were currently using GIS or had plans to use GIS in the next two years. The results of the FICCDC study on GIS was published in the report *A Summary of GIS Use in the Federal Government*.

Current applications analyzed in the report ranged from natural resource management to radio frequency planning and postal delivery/collection routes. Exhibit IV-1 presents a summary of the most common GIS applications in use or in the planning stages on the agency level.

Agencies reported terrain analysis as one of the most common uses for three-dimensional GIS. Among the applications from a civilian perspective are the abilities to examine the terrain of an area in 3-D for road construction and the analysis of land formations. Other applications currently being implemented include the analysis of land erosion by water and wind and site selection for the location of new buildings. Other applications deal with the environmental effects of acid rain, hazardous waste management, and global climate change research.

## EXHIBIT IV-1

## Major Federal GIS Applications

- Terrain analysis
- Natural resource analysis
- Land use analysis and management
- Pipeline/energy resource management
- Emergency/quarantine/crisis management
- Socioeconomic population planning and analysis
- Transportation/airspace planning and analysis

The 3-D maps created through the use of GIS are also used as one component of artificial intelligence systems that agencies use to train pilots for noncombat and combat situations. To further acquaint pilots with the layout of the Saudi desert and to assist in the location of targets, the Air Force used the Fairchild Defense System during the Gulf conflict. The simulation systems the DoD developed were originally for pilot training programs that allowed the pilots to accumulate air time without the risks associated with actual hands-on time in an airplane.

Other agencies are using the geographic mapping of the earth's layers to do the planning and analysis of natural resources. Through the use of geographic data bases of soils, hydrologic units, and other natural resource data, layer maps can be made of natural resources (by county and region). These maps assist in the planning of watersheds, river basins, analysis of vegetation patterns, and other programs to utilize our natural resources. The geologic data bases of natural resources facilitate the exploration of natural gas, oil, and other fossil fuel deposits.

The applications for land use management include the management of wildlife, rights of way corridors, recreation planning, and the tracking of rivers and crops. Long-term effects on the environment by urban centers and other human influences are also more manageable through the use of GIS. The National Flood Insurance program uses GIS to study flood areas and to assess the associated risks of flooding to people, animals, and property.

The Environmental Protection Agency, among other agencies, has implemented GIS projects to assess the impact on biological ecosystems caused by man-made and natural changes to the environment. In many cases they are allowed to predict the effects on the environment by the filling in of flood areas and the building of factories and office complexes in these areas. The agencies are better able to plan where nature needs man's help, as in the cases of planting trees or dredging a river to help adjust water run-off.

Transmission line routing, and ground water/oil/gas flow analysis represent some examples of GIS applications of pipeline and energy resource management. Federal agencies and state and local utilities are using the GIS applications to plan for meeting energy requirements of metropolitan areas and to create contingency plans in the events of primary power failures or natural disasters.

Emergency, quarantine, and crisis management applications of GIS include the ability to gather all available resources to deal with chemical spills, toxic waste, and hazardous materials accidents. Through the use of GIS, it is possible to manage quarantined areas and plan the weather and air pattern effects of nuclear and chemical spills. Agency officials are able to plan the spread pattern of radiation fall-out from nuclear test spots and plot the areas to be most affected by airborne hazardous gases.

Health and Human Services agencies are using GIS socioeconomic applications to relocate certain social services to areas that have the biggest need for them. The relocations of unemployment offices and health clinics are planned and justified through the GIS applications.

Through analysis of the census data, congressional and state representation can be redistributed to meet changes in the population. However, INPUT expects political considerations to play a more important role than GIS technology in state legislators' redistricting decisions.

Other agencies are planning for future population areas to ensure that necessary transportation and social services will be available as the population areas develop or shift. The Department of Transportation uses GIS to plan transportation routes under various population and emergency scenarios. If a national disaster occurs, where people and vehicles need to use alternate routes, the DOT has the capability to efficiently reroute land and air traffic. The railroads also support the transportation logistics system. Through the use of the transportation GIS, hazardous materials can be routed using the most efficient and least risky method of transportation.

## 2. Hardware/Software Platforms

Agencies primarily use microcomputers and workstations for processing the federal GIS applications studied, as shown in Exhibit IV-2. IBM and compatibles running DOS were mentioned as the microcomputer processing platform by 95% of the respondents. DEC, running under the VMS operating system, was mentioned most often as the minicomputer used. Seventy-one percent of the agencies that reported running GIS processing on workstations use the Sun workstation with the UNIX operating system. Currently, therefore, Sun enjoys high and favorable visibility in the federal GIS market.

### EXHIBIT IV-2

#### Equipment Platforms Used for GIS Applications

Platform	Percent of Mentions
Microcomputers	52
Workstations	37
Minicomputers	33
Mainframes	13

Multiple Responses Allowed

Only 13% of the agencies mentioned some GIS processing on mainframes. Of these agencies, only two agencies of the Department of Transportation and two agencies of the Department of Energy mentioned running over 75% of their GIS processing on mainframes. The remainder of the agencies ran 50% or less of their GIS applications on the mainframe, showing less importance of the mainframe environment for GIS.

Vendors who wish to target the GIS application market should develop their applications based on microcomputer or workstation platforms. The majority of the microcomputers installed for GIS applications are IBM or IBM compatibles. The majority of the workstation installed base for GIS applications is Sun equipment, operating under UNIX. Software vendors wishing to maximize their exposure to user agencies should develop products for this configuration.

### 3. Acquisition of GIS

Ninety-two percent of the agencies that INPUT interviewed in depth regarding their acquisition of GIS responded that they will be acquiring more GIS software in the near future. The majority of these agencies responded that the software acquisition would not necessarily be tied to any type of hardware purchase. This gives the software and services vendors more of an even chance competing with the hardware vendors for the available business, since the agencies are not predisposed to vendors that must supply hardware and software.

The agencies were asked to rate the various acquisition methods used by federal agencies to obtain hardware or software. Exhibit IV-3 presents the mean ratings of most popular current methods. The agencies showed no inclination to revise these methods for future acquisitions.

#### EXHIBIT IV-3

#### Agency Ratings of Acquisition Methods

Acquisition Method	Mean Rating
GSA Schedules	3.3
RFP	3.2
Requirements Contracts	3.1
Excess Equipment	1.6

It appears that the GSA schedules are the most favored for the acquisition of geographic information systems, with the RFP process being the second choice. Other methods that were mentioned include the Invitation For Bid (IFB) and blanket purchase agreements. The last two methods appear to be for special purposes, preferred under specific agency conditions.

Vendors seeking to gain entry into the federal GIS market or increase their market share should target the GSA schedules as part of their marketing plan.

Four of the agencies interviewed could not rate acquisition methods due to open RFPs.

#### 4. Agency Perceptions

The vast majority of the federal agencies interviewed are using off-the-shelf software for their GIS. Some of the agencies reported customizing their packages to fit specific agency data requirements. Six of the 110 agencies, surveyed in the FICCDC study, reported some amount of in-house-written software.

Exhibit IV-4 presents the perceptions of the agencies interviewed in-depth on selection criteria appropriate to their geographic information systems.

EXHIBIT IV-4

#### GIS Selection Criteria

Criteria	Mean Importance
Software Features	4.5
Equipment Reliability	4.4
Ease of Implementation	4.3
Vendor's Support Reputation	4.0
Product Price	3.5
Vendor's Federal Experience	2.3

Scale: 1-5; 1 = least important, 5 = most important

Software features appears to be one of the most important components of the GIS, with a mean importance rating of 4.5. As it related to software, ease of implementation of the system was also rated highly by respondents. Respondents also mentioned ease of use and a short learning curve as important criteria. For the users that have unique GIS requirements, software that facilitates user customization rated 5 in importance.

Vendors seeking to enter this market or expand their market share should keep the importance of these selection criteria in mind when planning new product development. Product price and the vendor's federal experience do not appear to be as important to the federal GIS market as they are in other areas.

Agencies were also questioned about the type of vendor they feel is most suitable for providing computers to their agency. Fifty-seven percent of the respondents noted they did not have a preference for the type of vendor providing the hardware to the agency; meeting the requirements of the RFP or Requirements Contract was more important than the type of vendor. Forty-three percent of the respondent agencies did have a preference, stating that hardware vendors were most appropriate for providing computers. This gives more opportunity for software and services firms to gain entrance to the GIS market, since meeting the requirements is more important than what type of vendor provides the system.

According to agency responses, data acquisition is seen as the most expensive aspect of developing a GIS. Exhibit IV-5 is a listing of this and other responses, based on frequency of agency mention. Software development and the development of the system itself was seen as the second most expensive aspect.

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**EXHIBIT IV-5**

### **Most Expensive Portions of GIS Development**

- Data acquisition
- Software/system development
- Data conversion
- Understanding the data
- Verifying the model

It appears that the actual development of the GIS and the acquisition of the data involved outweigh in expense the acquisition of the system hardware and the application software itself.

In one mission critical system, verifying the data model is a constant concern. In this system, the data analysis results must show very high accuracy, with a low margin for error.

## B

### OMB Circular A-16

On October 19, 1990, the Office of Management and Budget (OMB) issued the revised circular A-16, "Coordination of Surveying, Mapping, and Related Spatial Data." The circular expanded the mission of the FICCDC and assigned leadership roles to federal departments to facilitate the coordination of spatial data. Under the terms of the circular, the FICCDC was superseded by the new interagency coordinating committee, the Federal Geographic Data Committee (FGDC). This act of creating a new committee served to further emphasize the expanded scope of the interagency committee as it relates to national use of spatial data. The FGDC's primary mission champions the coordination of the development, use, sharing, and dissemination of surveying, mapping, and related spatial data.

These actions come as a result of the increasing demand on agencies of the federal government and the state and local governments to respond quickly to complex problems relating to geographic data. Administrative and regulatory pressures have also placed additional requirements on these agencies. Computerized geographic information systems have emerged as cost-efficient in providing the information required to make the necessary decisions. GIS data handling and analysis capabilities are extremely dependent on the availability and accuracy of spatial data.

Before the revision of A-16, the FICCDC focused on recommending procedures and programs that would facilitate the coordination of federal agencies' digital cartographic and geographic information system activities. A secondary emphasis concerned the establishment and promulgation of standards and specifications for the production of digital cartographic data. As the number of geographic information systems developed by federal and state and local agencies increased, it became apparent that there was a need to expand the scope of the FICCDC, with greater coordination and more emphasis on the development of standards.

Digital data has become the critical portion of the GIS, a common problem shared by all departments and agencies depending on the GIS to assist in their problem-solving needs. Agencies view data development as the most critical and most expensive portion of developing the GIS. The quality of the GIS and its resultant analyses depends on the quality

of the data going into the system. Increasing demand for this data, as well as the lack of coordination among the users of GIS spatial data, has led to much duplication of efforts in acquiring the data and the conversions required to use the data.

OMB believes that, through the building of innovative partnerships and the improved coordination resulting from the revised charter of the FICCDC, the U.S. can better deal with complex societal issues and world competition. The national infrastructure will facilitate the sharing and transfer of spatial data between the producers of data and the users. This will result in increased availability and timeliness of information on street/road networks, demographic and cultural patterns, and land use/land cover changes.

The Department of the Interior chairs the FGDC coordinating committee with representation from the following agencies:

- Department of Agriculture
- Department of Commerce
- Department of Defense
- Department of Energy
- Department of Housing and Urban Development
- Department of State
- Department of Transportation
- Federal Emergency Management Agency
- Environmental Protection Agency
- National Aeronautics and Space Administration
- National Archives and Records Administration

Other federal departments and independent agencies may request membership by writing to the Secretary of the Interior. The FGDC has the power to establish standards, procedures, and any other mechanisms necessary to carry out its coordination responsibilities.

## 1. Scope

The scope of the coordinating activities covered by circular A-16 extends to all GIS activities financed fully or partially by federal funds that can contribute to national mapping efforts, which include:

- National Mapping Program of the U.S. and outlying areas of sovereignty and jurisdiction
- National Geodetic Reference System
- National Geologic Mapping Program of the U.S. and outlying areas of sovereignty and jurisdiction

- National Wetlands Inventory Program
- National Cooperative Soil Survey Program
- National Public Land Survey System Geographic Coordinate Data as legal authority permits

Any other national surveying, mapping, or related spatial data program that may be established and that can contribute to the national surveying and mapping efforts also falls under the jurisdiction of the FGDC.

Excluded from the jurisdiction of the FGDC are surveying, mapping, and related spatial data activities conducted or supported by a federal agency that cannot be met with the national programs mentioned previously. Circular A-16 states however, that these activities should be conducted so that the data acquired is in a format that can be shared with other federal and non-federal agencies.

The agency managing the program determines the data requirements of the program. The FGDC representative, in consultation with the agency, evaluates the potential contribution of the data acquired to the national data bases of spatial data.

Circular A-16 also expanded the categories of spatial data coordinated by the FGDC from the original three (base topographic mapping, geodetic, and certain international boundaries) to 10 categories, adding geologic, soils, wetlands, vegetation, cadastral, cultural and demographic, and ground transportation.

## 2. Responsibilities

Under the revised circular A-16, the FGDC coordinates the surveying, mapping, and related spatial data activities encompassing the base topographic mapping, cadastral, geologic, geodetic, resource (soils, wetlands, and vegetation), cultural, demographic, and ground transportation categories of data that have multi-agency interest.

Exhibit IV-6 presents a list of GIS responsibilities by department. These departments divide the government-wide functions into (a) information exchange, (b) data transfer, (c) establishing and implementing quality, content, and data transfer standards, and (d) coordinating data acquisition.

In addition to the direct responsibilities that are listed in Exhibit IV-6, the departments also provide government-wide leadership to ensure that the activities relating to their direct program responsibilities are carried out.

## EXHIBIT IV-6

## Responsibilities by Department

Department	Responsibilities
• Interior	<ul style="list-style-type: none"><li>- National Mapping Program</li><li>- National Geologic Mapping Program</li><li>- Public Land Survey System of the U.S. and outlying areas of sovereignty and jurisdiction</li><li>- Public Land Conveyance (patent) Records</li><li>- National Wetlands Inventory</li></ul>
• Commerce	<ul style="list-style-type: none"><li>- National Geodetic Reference System (NGRS)</li><li>- Production and maintenance of nautical and aeronautical charts</li><li>- Collection, processing, and tabulation of cultural and demographic data</li><li>- Production of maps and other products concerning marine natural resources</li></ul>
• State	<ul style="list-style-type: none"><li>- Government-wide leadership regarding the cartographic representation of international boundaries</li></ul>
• Agriculture	<ul style="list-style-type: none"><li>- National Cooperative Soil Survey Program</li></ul>

- The Department of Interior exercises government-wide leadership to ensure that all surveying, mapping, digital cartographic, and related spatial data, earth science, and public land information needs are met in the most effective and efficient manner with the resources available. It also assesses all spatial data collected and makes a determination if the data can be made part of other national programs under the department's realm of responsibility. This assessment of the uses of the data reduces the amount of duplication of effort occurring in GIS data acquisition projects. Aerial photography and other remotely sensed imagery are also included in the available sets of spatial information.
- The Department of Interior, under circular A-16, has the additional responsibility of the standardization of geographic names and the official records of the names in conjunction with U.S. Board on Geographic Names.
- The Department of Commerce has the leadership function to ensure the coordinated planning and execution of national geodetic surveys, nautical and aeronautical charts, standards activities, and census and sample activities. Commerce is also involved in the evaluation of this data for use by other agencies with the same data requirements.
- The Department of Agriculture ensures that all digital soils and vegetation spatial data can be conveniently accessible for use in meeting the needs of other agencies and the general public.
- The Department of Transportation coordinates and plans for the collection, maintenance, and distribution of national ground transportation data. They ensure that all data collection financed by the federal government in this area will be usable and accessible by other agencies having the same data requirements.

### 3. Ramifications of Policy Changes

The revision of A-16 has led to several consequences relating to the expanded scope of GIS data coordination. It appears that there is a tremendous responsibility for the coordination of efforts in assembling a national data base of geographic information. Circular A-16 is unclear as to the authority of the FGDC to enforce any of its recommendations. FGDC has no recourse in the cases where agencies elect to duplicate data-gathering efforts and not subscribe to appropriate standards.

If the FGDC has the implied and explicit authority that it needs to carry out the stated mission, in the creation of a coordinated set of spatial data that can be used by many agencies may result. The National Digital Spatial Data Bases System (NDSDBS) would become the end product of an independently held and maintained set of coordinated spatial data.

The NDSDBS could include any spatial data bases that are federally held containing topographic, geodetic, geologic, soils, and wetlands data, and any other data that meets the content, quality, and transferability standards. Other data bases that become a part of the NDSDBS must also have the parent agencies' commitment to the quality, maintainability, and accessibility of the data.

## C

### Involvement of State/ Local Governments

#### 1. Current Projects

One of the most popular uses for GIS at the state level, the 911 emergency telephone number, is not commonly described as a geographic information system. However, many municipalities have or are developing this capability using geographic data bases of telephone numbers and addresses to locate emergency calls. This system is imperative in situations where the caller cannot identify the address to the police or emergency unit. In many cases, the local telephone company and the municipality are jointly developing the capability.

Other state projects incorporate geographic information to track or plan the reserves of suitable drinking water and waste discharge facilities sufficient for the population.

Waste disposal is another GIS layer that will be added to analyze the current capacities. By comparing the current population centers and the expected growth areas against the population areas that will experience the highest growth, local officials can predict where they will need to increase waste disposal capacities or shift capacities from one area to another. These systems assist the local governments in justifying new water and waste facilities before the population changes actually occur and put a strain on current capabilities.

Atlanta, Georgia is currently developing GIS capabilities to analyze the supplies of drinking water and facilities for waste discharge based on the population center requirements. These systems will plot the requirements for water against the current locations of suitable resources and alert the local authorities to the need for new sources to meet future requirements.

The state of Oregon is also developing a GIS capability to analyze the highest priority bodies of surface water as part of their state clean water strategy.

New Jersey is developing a geographic information system as part of the statewide environmental planning program that will analyze the effects of the population and industrial centers on the environment.

## 2. Federal versus State/Local Coordination

State and local data-gathering efforts sometimes duplicate federal work, which leads to redundancy, inconsistency, and higher costs. However, state, local and federal agencies also band together to share costs, responsibilities, and coordinated data.

The following have signed memorandums of understanding to coordinate GIS activities:

- Montana—coordination of efforts among 15 federal and state agencies
- Northwest Land Information Systems Network—partnership between federal and state agencies in Oregon and Washington. The agencies worked out cost sharing and data responsibility agreements to cut redundancy and storage costs. Six agencies in the NLISN have agreed to build a common data base and digital index in a pilot project for the Great Rond River.

## D

### War on Drugs

The President singled out GIS as one of the major methods of fighting the war on drugs in the U.S. Geographic information systems are being developed to track drug-related arrests and deaths, and drug traffic into the country. Through the analysis of this data, Customs and other agencies track and plan manpower to stop the flow of illegal drugs into the country.

In addition, the Justice Department plans to spend \$46 million through FY 1992 to set up an interagency National Drug Intelligence Center (NDIC). The NDIC will rely heavily on frequently updated GIS data to locate both likely growing areas as well as likely smuggling areas. It will electronically generate maps to facilitate agency planning. However, at this writing, Congress has yet to approve NDIC spending.

Similarly, the Defense Department is using GIS data to help integrate its surveillance data. Through artificial intelligence systems applied to GIS, DoD is able to pinpoint those areas with the highest potential for interdiction. In a related application, the Air Force is using customized software called "targetboard." It links the analytical features of Borland's Paradox relational data base with the broad range of graphics capabilities in Autodesk's AutoCAD software. The resulting graphics depend on GIS data for much of their input.

**E****Standards**

In the absence of national standards for GIS, some agencies are developing their own standards at the agency and interagency level. Thirty-five percent of the FICCDC agencies reported the use of standard definitions for data categories and data collection. The in-depth interviews by INPUT revealed the implementation of standards by 50% of the agencies. These agencies reported subscribing to agency or interagency-developed standards. The fairly low percentage of agencies implementing standards may be a result of the imminent release of Spatial Data Transfer Standard (SDTS) by the FGDC.

Spatial Data Transfer Standard sets forth a common exchange standard by which data may be transferred between producers and users. Differences in underlying concepts, terminology, and data formats in a given set of data make it difficult and inefficient for users to incorporate the data into their GIS plan. The common data transfer standard offers:

- A systematic and comprehensive set of building blocks from which cartographic features may be fashioned
- Transfer of digital spatial information between incompatible systems, while preserving the meaning of the information
- Data quality reporting to assist in the evaluation of data for a specific use
- Opportunity to share project costs by sharing data
- Resultant overall cost savings for obtaining and maintaining data
- Support for updating data through multiple sources

The standard was submitted to the National Institute for Standards and Technology in July, 1990. The proposed standard consists of three parts, as shown in Exhibit IV-7.

The logical specification conceptual model defines a set of primitive cartographic objects in zero, one, and two dimensions upon which more complex digital spatial representations can be built. It provides definitions for key conceptual terms used throughout the standard. The transfer specification defines the logical file structure for the transfer of data. Data quality specifies the form of the quality report, as defined by the lineage, position accuracy, attribute accuracy, logical consistency, and completeness.

## EXHIBIT IV-7

## Proposed Spatial Data Transfer Standard

- Logical Specification
  - Conceptual model and definitions
  - Transfer specifications
  - Data quality
- Spatial Features
  - Domain of cartographic entities and attributes
  - Terms to facilitate cross referencing
- International Standards Organization (ISO) Implementation
  - International standard ISO 8211 - *Information Processing Specification for a Data Descriptive File for Information Interchange*

Spatial features provide a list of standard topographic and hydrographic entities and attributes. Also resident is a mechanism for user-supplied entities, attributes, and their definitions to accompany the transfer.

The testing of the standard by the Technical Review Board was conducted in two phases, resulting in a rework of the standard. When the standard is complete or stable enough for commercial application, NIST will prepare a notice for the Federal Register and send the proposed standard to senior federal contacts for review. After comments, justifications, and approvals, the standard is submitted to the Secretary of Commerce for approval as a Federal Information Processing Standard (FIPS).

The National Digital Spatial Data Bases System (NDSDBS) is recommended as the standard system of independently held federal digital spatial data bases. The system is shown in Exhibit IV-8. Inclusion of spatial data bases would be contingent on the ability of the data to meet standards of content, quality, and transferability and be fully supported by the submitting agencies.

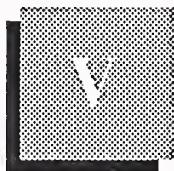
**EXHIBIT IV-8****National Digital Spatial Data Bases System (NDSDBS)**

- Geodetic
- Ground Transportation
- Geologic
- Soils
- Cultural and Demographic
- Wetlands
- Base Topographic
- Vegetation
- Cadastral
- Other Categories

The plan allows for other categories of data bases to be included in the NDSDBS by a review of the submitting agency's ability to meet technical requirements and the required level of management commitment.

The Technical Exchange Working Group of the FICCDC has prepared guidelines for evaluating GIS by agencies considering a geographic information system. *A Process For Evaluating Geographic Information Systems* provides an overview of GIS and general evaluation procedures

for agencies involved in the implementation or procurement of a geographic information system. The document provides a basic education in GIS for users new to the technology and includes a list of related GIS standards, guidelines, and references.



## Key Awards and Opportunities

The following chapter will present some of the recently announced awards and upcoming opportunities in the GIS market.

### A

#### Recent Awards

An automated navigational system for mapping ocean terrain is under development by the National Oceanic and Atmospheric Administration (NOAA). CartoAssociate, an expert system for detecting and resolving nautical charting problems, is part of the 10-year Automated Nautical Charting System 2 (ANCS 2) Project. Intergraph is developing the ANCS 2 Project for the NOAA. The CartoAssociate prototype uses Servio Corporation's Gemstone object server. Gemstone, designed for client/server use, is written in C and allows the storage of any digitized image.

The Environmental Protection Agency (EPA) recently awarded a \$347 million Technical and Operating Support Services (TOSS) contract to Computer Sciences Corporation (CSC). CSC will provide a geographic information system, office automation systems, records management system, and computer models. The contract will also allow CSC to extend its computer-related services to the EPA's 14 laboratories and 10 regional offices.

The Centers for Disease Control in Atlanta, GA has announced the purchase of Atlas GIS from Strategic Mapping, Inc. The software will run on a microcomputer system, providing map presentation and analysis software with a data base and drawing tools. The Center will use the Atlas GIS to analyze patterns of injuries in a biometrics mapping project.

## EXHIBIT V-1

## Recent Federal Government GIS Awards

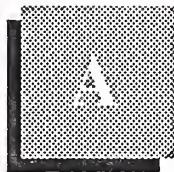
- National Oceanic and Atmospheric Administration (NOAA)
- Environmental Protection Agency (EPA)
- Centers for Disease Control (Atlanta, GA)

**B****Key Opportunities**

This chapter lists specific opportunities in the federal GIS market. A list of typical major programs for key agencies is provided. The list covers the period FY 1991 to FY 1996. Other new programs have not yet been identified or initially approved by the responsible agency. Subsequent issues of INPUT's Procurement Analysis Reports will include new programs and detailed program information for FY 1991 to FY 1996.

Agency Program	PAR Reference	RFP Schedule	FY 1991-FY 1996 Funding (Est. \$ Millions)
<b>Agriculture</b> Project 615	VI-5-30	7/91	106.5
<b>Commerce</b> Systems Engineering and Technical/Support Services	VI-6-40	Unk	Unk
<b>Energy</b> National Waste Information Network	VI-7-85	Unk	Unk
Licensing Support System	VI-7-87	Unk	13.0
<b>Interior</b> BLM ADP Modernization	VII-9-11	4/91	128.9
Earth Resources Observation System	VII-9-17	5/91	Unk
<b>Transportation</b> Real-Time Weather Processor Program	VII-11-39	2/91	Unk
<b>NASA</b> Earth Observing System	VIII-15-85	7/91	846.4





## Federal GIS Interview Profiles

### A

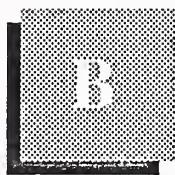
#### Federal Agency Respondent Profile

Contacts with agencies were made primarily by telephone with some additional surveys mailed. Representatives from the following agencies were interviewed:

- Department of Energy
  - Lawrence Livermore Labs
  - Richland Operations Office
- Federal Emergency Management Agency
- Department of Health and Human Services
- Department of Interior
  - Bureau of Indian Affairs
  - Bureau of Land Management
  - Bureau of Reclamation
- Department of Labor
- Department of Transportation
  - St. Lawrence Seaway
  - U.S. Coast Guard
  - Federal Railroad Administration
  - Transportation Systems Center
- Treasury Department

**B****Vendor Respondent  
Profile**

Vendors were not interviewed for this report.



## Definitions

The definitions in this appendix include hardware, software, services, and telecommunications categories to accommodate the range of information systems and services programs described in this report.

Alternate service mode terminology employed by the federal government in its procurement process is defined along with INPUT's regular terms of reference, as shown in Exhibit B-1.

The federal government's unique, nontechnical terminology, associated with applications, documentation, budgets, authorization, and the procurement/acquisition process, is included in Appendix C, Glossary of Federal Acronyms.

### A

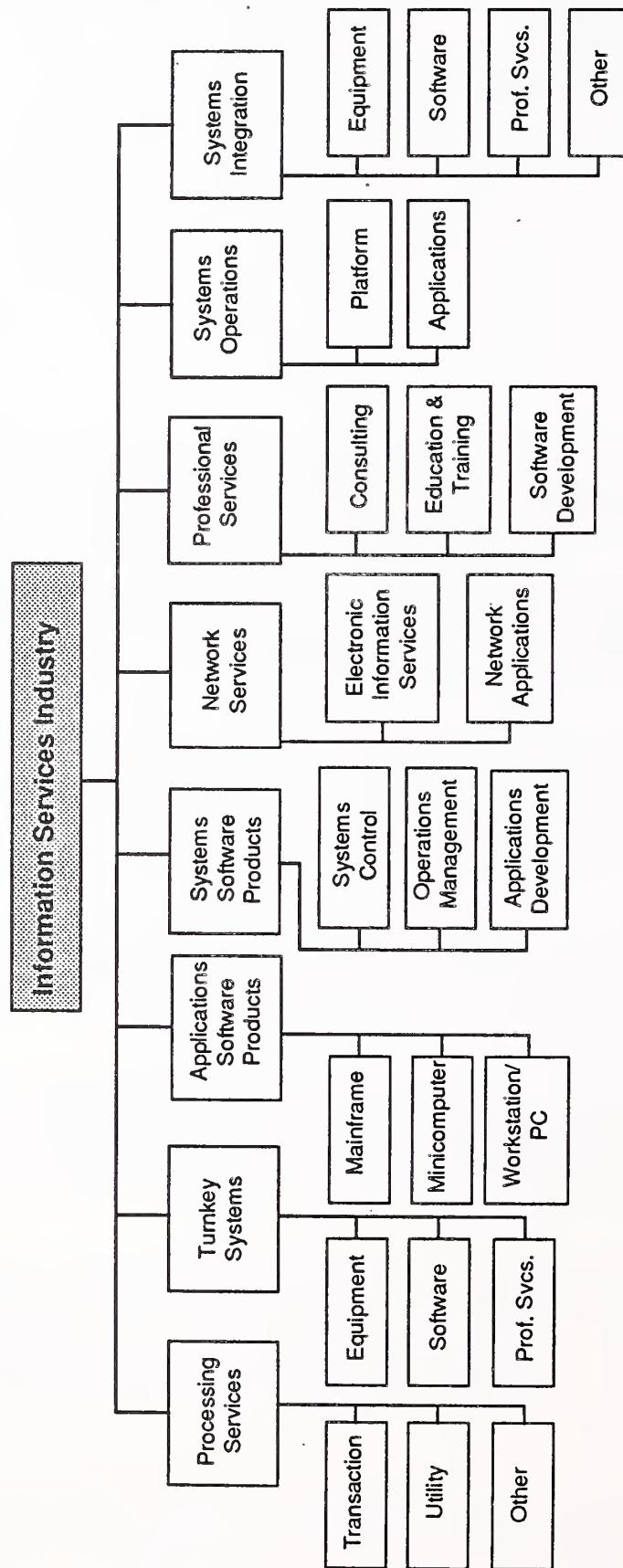
#### Delivery Modes

*Processing services* - This category includes transaction processing, utility processing, other processing services, and processing facilities management.

- *Transaction Processing Services* - Updates client-owned data files by entry of specific business activity, such as sales order, inventory receipt, cash disbursement, etc. Transactions may be entered in one of these modes:
  - *Interactive* - Characterized by the interaction of the user with the system, primarily for problem-solving timesharing, but also for data entry and transaction processing; the user is on-line to the program files. Computer response is usually measured in seconds or fractions of a second.
  - *Remote Batch* - The user hands over control of a job to the vendor's computer, which schedules job execution according to priorities and resource requirements. Computer response is measured in minutes or hours.

## EXHIBIT B-1

## Information Services Industry Structure—1991



Source: INPUT

*User Site Hardware Services (USHS)* - Those offerings provided by processing services vendors which place programmable hardware at the user's site, rather than at the vendor's data center. Some vendors in the federal government market provide this service under the label of distributed data services. USHS offers the following:

- Access to a communications network
- Access through the network to the RCS vendor's larger computers
- Local management and storage of a data base subset that will serve local terminal users via the connection of a data base processor to the network
- Significant software as part of the service
- *Utility Processing* - Vendor provides access to basic software tools, enabling the users to develop their own problems solutions such as language compilers assemblers, DBMS, sorts scientific library routines, and other systems software.

Other processing services include the following:

- *Batch Services* - These include data processing at vendors' sites for user programs and/or data that are physically transported (as opposed to transported electronically by telecommunications media) to and/or from those sites. Data entry and data output services, such as keypunching and computer output microfilm processing, are also included. Batch services include expenditures by users who take their data to a vendor site with a terminal connected to a remote computer for the actual processing. Other services also includes disaster recovery and backup services.
- *Systems Operations (Processing)* - Also referred to as Resource Management, Facilities Management or COCO (contractor-owned, contractor-operated). Systems control is the management of all or part of a user's data processing functions under a long-term contract of not less than one year. This would include remote computing and batch services. To qualify, the contractor must directly plan, control, operate, and own the facility provided to the user, either onsite, through communications lines, or in a mixed mode.

Processing services are further differentiated as follows:

- Cross-industry services involve the processing of applications targeted to specific user departments (e.g., finance, personnel, sales) but cutting across industry lines. Most general-ledger, accounts receivable, payroll, and personnel applications fall into this category.

Cross-industry data base services, for which the vendor supplies the data base and controls access to it (although it may be owned by a third party), are included in this category. General-purpose tools such as financial planning systems, linear regression packages, and other statistical routines are also included. When the application, tool, or data base is designed for specific industry use, however, the services are industry-specific (see below).

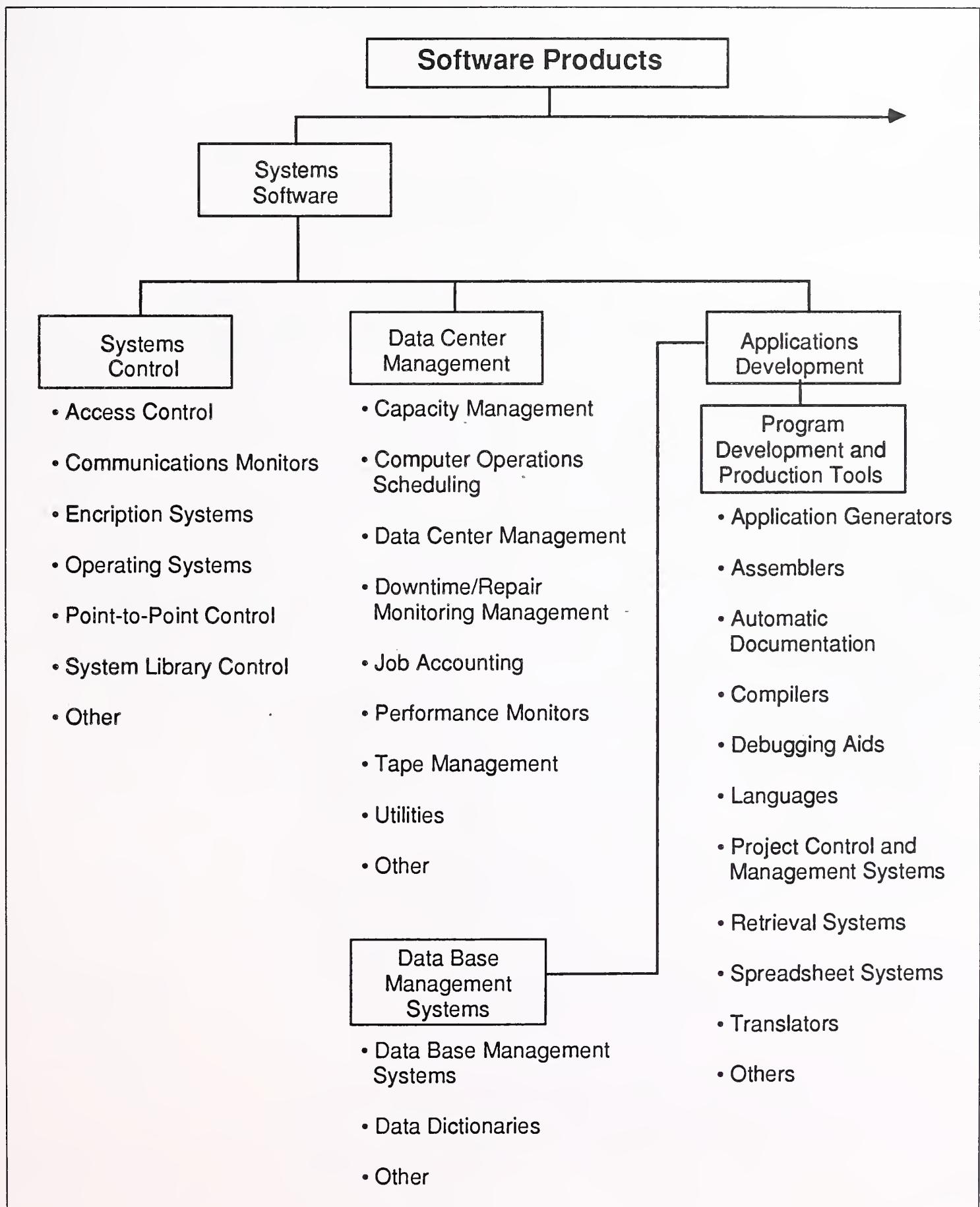
- Industry-specific services provide processing for particular functions or problems unique to an industry or industry group. Specialty applications can be used for either business or scientific purposes. Industry-specific data base services, for which the vendor supplies the data base and controls access to it (although it may be owned by a third party), are also included under this category. Examples of industry-specialty applications are seismic data processing, numerically controlled machine tool software development, and demand deposit accounting.

Network services include a wide variety of network-based functions and operations. The common thread is that more of these functions could be performed without network involvement. Network services is divided into two segments: value-added networks (enhanced services) and network applications (electronic information systems).

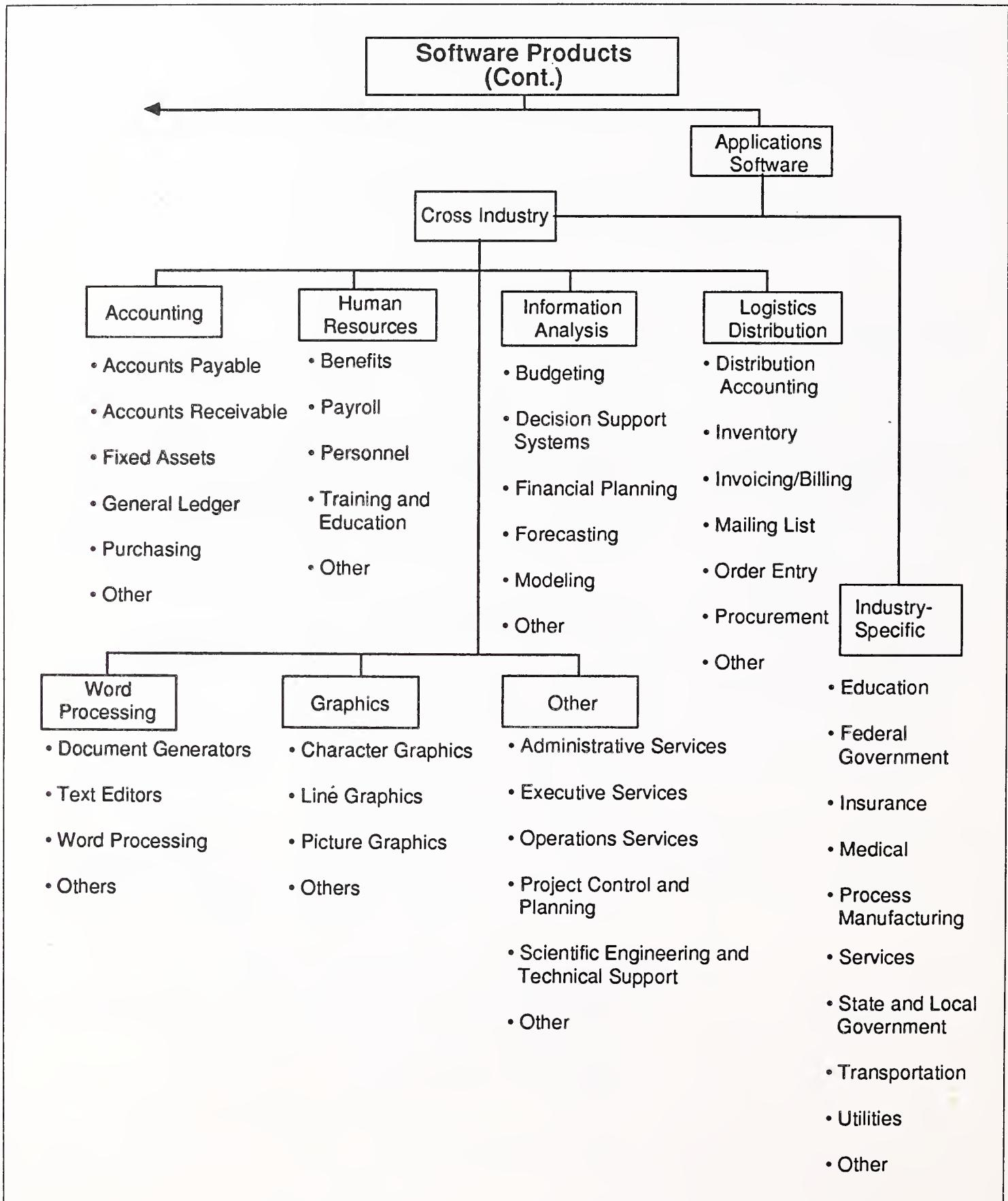
- *Value-Added Networks (VANs)* - VANs typically involve common carrier network transmission facilities augmented by computerized switches. These networks have become associated with packet-switching technology because the public VANs that have received the most attention (e.g., Telenet and TYMNET) employ packet-switching techniques. But other added data service features such as store-and-forward message switching, terminal interfacing, error detection and correction, and host computer interfacing are of equal importance.
- Network applications include Electronic Data Interchange (EDI), the application-to-application electronic communications between organizations, based on established business document standards, and electronic mail.

*Software products* - This category comprises user purchases of applications and systems software packages for in-house computer systems. Included are expenditures for lease and purchase, and for work performed by the vendor to implement or maintain the package at the user's sites. Expenditures for work performed by organizations other than the package vendor are counted in the category of professional services. Fees for work related to education, consulting, and/or custom modification of software products are counted as professional services, provided such fees are charged separately from the price of the software product itself. Software products have several subcategories, as indicated below and shown in detail in Exhibit B-2.

## EXHIBIT B-2



## EXHIBIT B-2 (Cont.)



- *Applications Products* - Software that performs functions directly related to solving user's business or organizational need. The products can be any of the following:
  - *Cross-Industry Products* - Used in multiple-industry applications as well as the federal government sector. Examples are payroll, inventory control, and financial planning.
  - *Industry-Specific Products* - Used in a specific industry sector, such as banking and finance, transportation, or discrete manufacturing. Examples are demand deposit accounting, airline scheduling, and material resource planning.
- *Systems Software Products* - Software enabling the computer/communications system to perform basic functions. These products include the following:
  - *System Control Products* - Function during applications program execution to manage the computer system resources. Examples include operating systems, communications monitors, emulators, spoolers, network control, library control, windowing, and access control.
  - *Data Center Management Products* - Used by operations personnel to manage the computer systems resources and personnel more effectively. Examples include performance measurement, job accounting, computer operations scheduling, utilities, and capacity management.
  - *Applications Development Products* - Used to prepare applications for execution by assisting in designing, programming, testing, and related functions. Examples include traditional programming languages, 4GLs, sorts, productivity aids, assemblers, compilers, data dictionaries, data base management systems, report writers, project control, and CASE systems.

*Professional Services* - This category includes consulting, education and training, software development, and systems operations, as defined below:

- *Software Development* - Develops a software system on a custom basis. It includes one or more of the following: user requirements definition, system design, contract, programming, and/or documentation.
- *Education and Training* - Products and/or services related to information systems and services for the user, including computer-aided instruction (CAI), computer-based education (CBE), and vendor instruction of user personnel in operations, programming, and maintenance

- *Consulting Services* - Information systems and/or services management consulting, project assistance (technical and/or management), feasibility analyses, and cost-effectiveness trade-off studies
- *Systems Operations (Professional Services)* - This is a counterpart to systems operations (professional services) except the computing equipment is owned or leased by the client, not by the vendor. The vendor provides the staff to operate, maintain, and manage the client's facility.

*Turnkey Systems* - A turnkey system is an integration of systems and applications software with CPU hardware and peripherals, packaged as a single application (or set of applications) solution. The value added by the vendor is primarily in the software and support. Most CAD/CAM systems and many small-business systems are turnkey systems. This does not include specialized hardware systems such as word processors, cash registers, or process control systems; nor does it include Embedded Computer Resources for military applications. They may be either custom or packaged systems.

- Hardware vendors that combine software with their own general-purpose hardware are not classified by INPUT as turnkey vendors. Their software revenues are included in the appropriate software category.
- Turnkey systems revenue is divided into two categories:
  - *Industry-specific systems* - Systems serving a specific function for a given industry sector such as automobile dealer parts inventory, CAD/CAM systems, or discrete manufacturing control systems
  - *Cross-industry systems* - Systems providing a specific function applicable to a wide range of industry sectors, such as financial planning systems, payroll systems, or personnel management systems
- Revenue includes hardware, software, and support functions.

*Systems Integration* - (SI) delivery of large, complex multidisciplinary, multivendor systems, incorporating some or all of these categories: systems design, programming, integration, equipment, packaged software, communication networks, installation, education and training, and SI related professional services and acceptance. Systems integration contracts typically take more than a year to complete, and involve a prime contractor assuming risk and accepting full responsibility.

**B****Hardware/Hardware Systems**

*Hardware* - Includes all computer and telecommunications equipment that can be separately acquired with or without installation by the vendor and not acquired as part of an integrated system

- *Peripherals* - Includes all input, output, communications, and storage devices (other than main memory) that can be connected locally to the main processor, and generally cannot be included in other categories such as terminals
- *Input Devices* - Includes keyboards, numeric pads, card readers, light pens and track balls, tape readers, position and motion sensors, and analog-to-digital converters
- *Output Devices* - Includes printers, CRTs, projection television screens, micrographics processors, digital graphics, and plotters
- *Communication Devices* - Includes modem, encryption equipment, special interfaces, and error control
- *Storage Devices* - Includes magnetic tape (reel, cartridge, and cassette), floppy and hard disks, solid state (integrated circuits), and bubble and optical memories

*Terminals* - Three types of terminals are described below:

- *User Programmable* - Also called intelligent terminals, including the following:
  - Single-station or standalone
  - Multistation, shared processor
  - Teleprinter
  - Remote batch
- *User Nonprogrammable*
  - Single-station
  - Multistation, shared processor
  - Teleprinter
- *Limited Function* - Originally developed for specific needs, such as point-of-sale (POS), inventory data collection, controlled access, and other applications

*Hardware Systems* - Includes all processors from microcomputers to supercomputers. Hardware systems may require type- or model-unique

operating software to be functional, but this category excludes applications software and peripheral devices, other than main memory and processors or CPUs not provided as part of an integrated (turnkey) system.

- *Microcomputer* - Combines all of the CPU, memory, and peripheral functions of an 8-, 16-, or 32-bit computer on a chip in various forms including:
  - Integrated circuit package
  - Plug-in boards with increased memory and peripheral circuits
  - Console including keyboard and interfacing connectors
  - Personal computer with at least one external storage device directly addressable by the CPU
  - An embedded computer which may take a number of shapes or configurations
- *Midsize Computer* - Typically a 32- or 64-bit computer with extensive applications software and a number of peripherals in stand-alone or multiple-CPU configurations for business (administrative, personnel, and logistics) applications; also called a general purpose computer. All Intel 80386, Motorola 68000-based systems, and large multiuser systems are included. Specific systems in this category are as follows: IBM 93XX systems; all Digital VAX series systems; and such common UNIX-based systems as those from Apollo and Sun are also included. Most large, shared-logic, integrated office systems—such as those from Wang, Hewlett-Packard, and Honeywell Bull—would also be considered midsized systems. However, this category does not include microcomputers (standalone, or shared), embedded systems, or CAD/CAM systems.
- *Large Computer* - Presently centered on storage controllers, but likely to become bus-oriented and to consist of multiple processors or parallel processor. Intended for structured mathematical and signal processing and typically used with general purpose, Von Neumann-type processors for system control. This term usually refers to traditional mainframes and supercomputers.
- *Supercomputer* - High-powered processors with numerical processing throughput that is significantly greater than the fastest general purpose computers, with capacities in the 100-500 million floating point operations per second (MFLOPS) range. Newer supercomputers, with burst modes over 500 MFLOPS, main storage size up to 10 million words, and on-line storage in the one-to-four gigabyte class, are labeled Class V to Class VII in agency long-range plans. Supercomputers fit in one of two categories:

- *Real Time* - Generally used for signal processing in military applications
- *Non-Real Time* - For scientific use in one of three configurations:
  - Parallel processors
  - Pipeline processor
  - Vector processor
- *Supercomputer* - Term applied to micro, mini, and large mainframe computers with performance substantially higher than attainable by Von Neumann architectures
- *Embedded Computer* - Dedicated computer system designed and implemented as an integral part of a weapon, weapon system, or platform; critical to a military or intelligence mission such as command and control, cryptological activities, or intelligence activities. Characterized by military specifications (MIL SPEC) appearance and operation, limited but reprogrammable applications software, and permanent or semipermanent interfaces. These systems may vary in capacity from microcomputers to parallel processor computer systems.

## C

### Telecommunications

*Networks* - Electronic interconnection between sites or locations; may incorporate links between central computer sites and remote locations and switching and/or regional data processing nodes. Network services typically are provided on a leased basis by a vendor to move data, voice, video, or textual information between locations. Networks can be categorized in several different ways:

- *Common Carrier Network* - A public access network, such as AT&T, consisting of conventional, voice-grade circuits and regular switching facilities reached by dial-up calling with leased or user-owned modems for transfer rates between 150 and 1200 baud
- *Value-Added Network (VAN)* - (See listing under Section B, Delivery Modes.)
- *Local-Area Network (LAN)* - Limited-access network between computing resources in a relatively small (but not contiguous) area, such as a building, complex of buildings, or buildings distributed within a metropolitan area. LANs use one of two signaling methods:
  - *Baseband* - Signaling using digital waveforms on a single-frequency band, usually at voice frequencies and bandwidth, and limited to a single sender at any given moment. When used for local-area networks, a baseband is typically used with TDM to permit multiple access.

- *Broadband* - Transmission facilities that use frequencies greater than normal voice-grade, supported in local-area networks with RF modems and AC signaling. Also known as wideband. Employs multiplexing techniques that increase carrier frequency between terminals to provide various services:
  - Multiple (simultaneous) channels via FDM (Frequency Division Multiplexing)
  - Multiple (time-sequenced) channels via TDM (Time Division Multiplexing)
  - High-speed data transfer rate via parallel mode at rates of up to 96,000 baud (or higher, depending on media)
  - *Wide-Area Network (WAN)* - Limited access network between computing resources in buildings, complexes of buildings, or buildings within a large metropolitan or wide geographical area. WANs use baseband or broadband signaling methods.
- *Transmission Facilities* - Includes wire, carrier, coaxial cable, microwave, optical fiber, satellites, cellular radio, and marine cable operating in one of two modes depending on the vendor and the distribution of the network
- *Mode* - may be either analog or digital:
  - *Analog* - Transmission or signal with continuous-waveform representation, typified by AT&T's predominantly voice-grade DDD network and most telephone operating company distribution systems
  - *Digital* - Transmission or signal using discontinuous, discrete quantities to represent data, record, video, or text in binary form
- *Media* - may be any of the following:
  - *Wire* - Varies from earlier, single-line, teletype networks, to two-wire standard telephone (twisted pair), to four-wire, full-duplex, balanced lines
  - *Carrier* - A wave, pulse train, or other signal suitable for modulation by an information-bearing signal to be transmitted over a communications system, used in multiplexing applications to increase network capacity
  - *Coaxial Cable* - A cable used in HF (high-frequency) and VHF (very high frequency), single-frequency, or carrier-based systems, which

requires frequent reamplification (repeaters) to carry the signal any distance

- *Microwave* - UHF (ultra-high-frequency) multichannel, point-to-point, repeated radio transmission, also capable of wide frequency channels
- *Optical Fiber* - Local signal distribution systems employed in limited areas, using light-transmitting glass fibers and TDM for multichannel applications
- *Communications Satellites* - Synchronous, earth-orbiting systems that provide point-to-point, two-way service over significant distances without intermediate amplification (repeaters), but requiring suitable groundstation facilities expand markets for those technologies, and leverage existing and new product lines. In effect, they are focused on using their typically limited professional services resources to maximize the return on their core business products. This is true in most cases for federal market vendors as well. Most hardware firms prefer to apply their own core business products, and cannot avoid the use of the hardware of other manufacturers. This policy may limit their ability to respond to all systems integration asynchronous or synchronous, half or full duplex.

## D

### General Definitions

*ASCII* - American National Standard Code for Information Interchange—Eight-bit code with seven data bits and one parity bit

*Asynchronous* - Communications operation (such as transmission) without continuous timing signals. Synchronization is accomplished by appending signal elements to the data.

*Bandwidth* - Range of transmission frequencies that can be carried on a communications path; used as a measure of capacity.

*Baud* - Number of signal events (discrete conditions) per second. Typically used to measure modem or terminal transmission speed.

*Byte* - Usually equivalent to the storage required for one alphanumeric character (i.e., one letter or number)

*CBX* - Computerized Branch Exchange—A PABX based on a computer system, implying programmability and usually voice and data capabilities

*Central Processing Unit (CPU)* - The arithmetic and control portion of a computer; i.e., the circuits controlling the interpretation and execution of computer instructions.

*Centrex* - Central office telephone services that permit local circuit switching without installation of customer premises equipment. Could be described as shared PBX service.

*Circuit Switching* - A process that, usually on demand, connects two or more network stations, and permits exclusive circuit use until the connection is released; typical of the voice telephone network, where a circuit is established between the caller and the called party.

*CO* - Central Office—Local telco site for one or more exchanges

*CODEC* - Coder/decoder, equivalent to modem for digital devices

*Constant Dollars* - Growth forecasts in constant dollars make no allowance for inflation or recession. Dollar value based on the year of the forecast unless otherwise indicated.

*Computer System* - The combination of computing resources required to perform the designed functions. May include one or more CPUs, machine room peripherals, storage systems, and/or applications software.

*CPE* - Customer Premises Equipment—DCE or DTE located at a customer site rather than at a carrier site such as the local telephone company CO. May include switchboards, PBX, data terminals, and telephone answering devices.

*CSMA/CD* - Carrier Sense Multiple Access/Collision Detect—Contention protocol used in local-area networks, typically with a multipoint configuration

*Current Dollars* - Estimates or values expressed in current-year dollars which, for forecasts, would include an allowance for inflation

*Data Encryption Standard (DES)* - Fifty-six-bit key, one-way encryption algorithm adopted by NIST in 1977, implemented through hardware (“S-boxes”) or software. Designed by IBM with NSA guidance.

*Datagram* - A self-contained packet of information that does not depend on the contents of preceding or following packets and has a finite length

*DCA* - IBM's Document Content Architecture—Protocols for specifying document (text) format which are consistent across a variety of hardware and software systems within IBM's DISOSS

*DCE* - Data Circuit-terminating Equipment—Interface hardware that couples DTE to a transmission circuit or channel by providing functions to establish, maintain, and terminate a connection, including signal conversion and coding

*DDCMP* - Digital Data Communications Message Protocol —Data link protocol used in Digital Equipment Company's DECNET

*DECNET* - Digital Equipment Company's network architecture

*Dedicated Circuit* - A permanently established network connection between two or more stations; contrast with switched circuit

*DEMS* - Digital Electronic Message Service—Nationwide common carrier digital networks which provide high-speed, end-to-end, two-way transmission of digitally encoded information using the 10.6 GHz band

*DIA* - IBM's Document Interchange Architecture - Protocols for transfer of documents (text) between different hardware and software systems within IBM's DISOSS

*DISOSS* - IBM's DIStributed Office Support System - Office automation environment, based on DCA and DIA, which permits document (text) transfer between different hardware and software systems without requiring subsequent format or content revision

*Distributed Data Processing* - The development of programmable intelligence in order to perform a data processing function where it can be accomplished most effectively through computers and terminals arranged in a telecommunications network adapted to the user's needs

*DTE* - Data Terminal Equipment—Hardware which is a data source, link, or both, such as video display terminals that convert user information into data transmission, and reconvert data signals into user information

*EBCDIC* - Extended Binary Coded Decimal Interchange Code —Eight-bit code typically used in IBM mainframe environments

*EFT* - Electronic funds transfer

*Encryption* - Electric, code-based conversion of transmitted data to provide security and/or privacy of data between authorized access points

*End User* - One who is using a product or service to accomplish his or her own functions. The end user may buy a system from the hardware supplier(s) and do his or her own programming, interfacing, and installation. Alternately, the end user may buy a turnkey system from a systems house or hardware integrator, or may buy a service from an in-house department or external vendor.

*Engineering Change Notice (ECN)* - Product improvements after production

*Engineering Change Order (ECO)* - The follow-up to ECNs, including parts and a bill of materials to effect the change in the hardware

*Equipment Operators* - Individuals operating computer control consoles and/or peripheral equipment (BLS definition)

*Ethernet* - Local-area network developed by Xerox PARC using baseband signaling, CSMA/CD protocol, and coaxial cable to achieve a 10 mbps data rate

*Facsimile* - Transmission and reception of graphic data, usually fixed images of documents, through scanning and conversion of a picture signal

*FDM* - Frequency Division Multiplexing—A multiplexing method that permits multiple access by assigning different frequencies of the available bandwidth to different channels

*FEP* - Front-End Processor—Communications concentrator such as the IBM 3725 or COMTEN 3690 used to interface communications lines to host computers

*Field Engineer (FE)* - Field engineer, customer engineer, serviceperson, and maintenance person are used interchangeably and refer to the individual who responds to a user's service call to repair a device or system.

*Full-Duplex* - Bi-directional communications, with simultaneous, two-way transmission

*General Purpose Computer System* - A computer designed to handle a wide variety of problems. Includes machine room peripherals, systems software, and small business systems.

*Half-Duplex* - Bi-directional communications, but only in one direction at a time

*Hardware Integrator* - Develops system interface electronics and controllers for the CPU, sensors, peripherals, and all other ancillary hardware components. The hardware integrator also may develop control system software in addition to installing the entire system at the end-user site.

*HDLC* - High-level Data Link Control

*Hertz* - Number of signal oscillations (cycles) per second, abbreviated Hz

*IBM Token Ring* - IBM's local area network using baseband signalling and operating at 4 mbps on twisted-pair copper wire. Actually a combination of star and ring topologies—IEEE 802.5-compatible.

*IDN* - Integrated Digital Network—Digital switching and transmission; part of the evolution to ISDN.

*Independent Suppliers* - Suppliers of machine room peripherals, though usually not suppliers of general purpose computer systems

*Information Processing* - Data processing as a whole, including use of business and scientific computers

*Installed Base* - Cumulative number or value (cost when new) of computers in use

*Interconnection* - Physical linkage between devices on a network

*Interoperability* - The capability to operate with other devices on a network. Different from interconnection, which merely guarantees a physical network interface.

*ISDN* - Integrated Services Digital Network—Completely digital, integrated voice and nonvoice public network service. Not clearly defined through any existing standards, although FCC and other federal agencies are developing CCITT recommendations.

*Keypunch Operators* - Individuals operating keypunch machines (similar to electric typewriters) to transcribe data from source materials onto punch cards

*Lease Line* - Permanent connection between two network stations. Also known as dedicated or non-switched line.

*Machine Repairers* - Individuals who install and periodically service computer systems

*Machine Room Peripherals* - Peripheral equipment generally located close to the central processing unit

*Mainframe* - The central processing unit (CPU or units in a parallel processor) of a computer that interprets and executes computer (software) instructions of 32 bits or more

*MAP* - Manufacturing Automation Protocol - Seven-layer communications standard for factory environments promoted by General Motors/EDS. Adopts IEEE 802.2 and IEEE 802.4 standards plus OSI protocols for other layers of the architecture.

*Mean Time to Repair* - The mean of elapsed times from the arrival of the field engineer on the user's site to the time when the device is repaired and returned to user service

*Mean Time to Respond* - The mean of elapsed times from the user call for services and the arrival of the field engineer on the user's site

*Message* - A communication intended to be read by a person. The quality of the received document need not be high, only readable. Graphic materials are not included.

*MMFS* - Manufacturing Messaging Format Standard—Application-level protocol included within MAP

*Modem* - A device that encodes information into electronically transmittable form (MOdulator) and restores it to original analog form (DEModulator)

*NCP* - Network Control Program—Software used in IBM 3705/3725 FEPs for control of SNA networks.

*Node* - Connection point of three or more independent transmission points which may provide switching or data collection

*Off-Line* - Pertaining to equipment or devices that can function without direct control of the central processing unit

*On-Line* - Pertaining to equipment or devices under direct control of the central processing unit

*OSI* - ISO reference model for Open Systems Interconnection—Seven-layer architecture for application, presentation, session, transport, network, data link, and physical services and equipment

*OSI Application Layer* - Layer 7, providing end-user applications services for data processing

*OSI Data Link Layer* - Layer 2, providing transmission protocols, including frame management, link flow control, and link initiation/release

*OSI Network Layer* - Layer 3, providing call establishment and clearing control through the network nodes

*OSI Physical Layer* - Layer 1, providing the mechanical, electrical, functional, and procedural characteristics to establish, maintain, and release physical connections to the network

*OSI Presentation Layer* - Layer 6, providing data formats and information such as data translation, data encoding/decoding, and command translation

*OSI Session Layer* - Layer 5, establishes, maintains, and terminates logical connections for the transfer of data between processes

*OSI Transport Layer* - Layer 4, providing end-to-end terminal control signals such as acknowledgements

*Overseas* - Not within the geographical limits of the continental United States, Alaska, Hawaii, and U.S. possessions

*PABX* - Private Automated Branch Exchange—Hardware that provides automatic (electro-mechanical or electronic) local circuit switching on a customer's premises

*PAD* - Packet Assembler-Disassembler—A device that enables DTE not equipped for packet switching operation to operate on a packet switched network

*PBX* - Private Branch Exchange—Hardware that provides local circuit switching on the customer premise

*PCM* - Pulse-Code Modulation—Modulation involving conversion of a waveform from analog to digital form through coding

*PDN* - Public Data Network—A network established and operated by a recognized private operating agency, a telecommunications administration, or other agency for the specific purpose of providing data transmission services to the public

*Peripherals* - Any unit of input/output equipment in a computer system, exclusive of the central processing unit

*PPM* - Pulse Position Modulation

*Private Network* - A network established and operated for one user or user organization

*Programmers* - Persons mainly involved in designing, writing, and testing computer software programs

*Protocols* - The rules for communication system operation that must be followed if communication is to be effected. Protocols may govern portions of a network or service. In digital networks, protocols are digitally encoded as instructions to computerized equipment.

*Public Network* - A network established and operated for more than one user with shared access, usually available on a subscription basis. See related international definition of PDN.

*Scientific Computer System* - A computer system designed to process structured mathematics (such as Fast Fourier Transforms), and complex, highly redundant information (such as seismic data, sonar data, and radar), with large, on-line memories and very high-capacity output

*SDLC* - Synchronous Data Link Control—IBM's data link control for SNA. Supports a subset of HDLC modes.

*SDN* - Software-Defined Network

*Security* - Physical, electrical, and computer (digital) coding procedures to protect the contents of computer files and data transmission from inadvertent or unauthorized disclosure to meet the requirements of the Privacy Act and national classified information regulations

*Service Delivery Point* - The location of the physical interface between a network and customer/user equipment

*Simplex* - Unidirectional communications

*Smart Box* - A device for adapting existing DTE to new network standards such as OSI. Includes PADs and protocol convertors, for example.

*SNA* - Systems Network Architecture—Seven-layer communications architecture designed by IBM. Layers correspond roughly but not exactly to OSI model.

*Software* - Computer programs

*Supplies* - Includes materials associated with the use of operations of computer systems, such as printer paper, keypunch card, disk packs, and tapes

*Switched Circuit* - Temporary connection between two network stations established through dial-up procedures

*Synchronous* - Communications operation with separate, continuous clocking at both sending and receiving stations

*Systems Analyst* - Individual who analyzes problems to be converted to a programmable form for application to computer systems

*Systems House* - Vendor that acquires, assembles, and integrates hardware and software into a total system to satisfy the data processing requirements of an end user. The vendor also may develop systems software products for license to end users. The systems house vendor does not manufacture mainframes.

*Systems Integrator* - Systems house vendor that develops systems interface electronics, applications software, and controllers for the CPU, peripherals, and ancillary subsystems which may have been provided by a contractor or the government (GFE). This vendor may either supervise or perform the installation and testing of the completed system.

*T1* - Bell System designation for 1.544 mbps carrier capable of handling 24 PCM voice channels

*TDM* - Time Division Multiplexing—A multiplexing method that interleaves multiple transmissions on a single circuit by assigning a different time slot to each channel.

*Token Passing* - Local-area network protocol which allows a station to transmit only when it has the “token,” an empty slot on the carrier

*TOP* - Technical Office Protocol —Protocol developed by Boeing Computer Services to support administrative and office operations as complementary functions to factory automation implemented under MAP

*Turnkey System* - System composed of hardware and software integrated into a total system designed to fulfill completely the processing requirements of a single application

*Twisted-Pair Cable* - Communications cabling consisting of pairs of single-strand metallic electrical conductors, such as copper wires, typically used in building telephone wiring and some LANs

*Verification and Validation* - Process for examining and testing applications and special systems software to verify that it operates on the target CPU and performs all of the functions specified by the user

*Voice-Grade* - Circuit or signal in the 300-3300 Hz bandwidth typical of the public telephone system, nominally a 4 Khz user

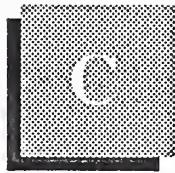
*VTAM* - Virtual Telecommunications Access Method—Host-resident communications software for SNA networks

## E

### Other Considerations

When questions arise as to the proper place to count certain user expenditures, INPUT addresses the questions from the user viewpoint. Expenditures are then categorized according to the users' perception of the purchase.





## Glossary of Acronyms

The federal government's procurement language uses a combination of acronyms, phrases, and words that is complicated by different agency definitions and interpretations. The government also uses terms of accounting, business, economics, engineering, and law with new applications and technology.

Acronyms and contract terms that INPUT encountered most often in program documentation and interviews for this report are listed below, but this glossary should not be considered all-inclusive. Federal procurement regulations (DAR, FPR, FAR, FIRMR, FPMR) and contract terms listed in RFIs, RFPs, and RFQs provide applicable terms and definitions.

Federal agency acronyms have been included if they are used in this report.

### A

#### Federal Acronyms

AAS	Automatic Addressing System.
AATMS	Advanced Air Traffic Management System.
ACO	Administrative Contracting Offices (DCAS).
ACS	Advanced Communications Satellite (formerly NASA 30/20 GHz Satellite Program).
ACT-1	Advanced Computer Techniques (Air Force).
Ada	DoD High-Order Language.
ADA	Airborne Data Acquisition.
ADL	Authorized Data List.
ADS	Automatic Digital Switches (DCS).
AFA	Air Force Association.
AFCEA	Armed Forces Communications Electronics Association.
AGE	Aerospace Ground Equipment.
AIP	Array Information Processing.
AIS	Automated Information System.
AMPE	Automated Message Processing Equipment.

AMPS	Automated Message Processing System.
AMSL	Acquisition Management Systems List.
ANG	Army National Guard.
AP(P)	Advance Procurement Plan.
Appropriation	Congressionally approved funding for authorized programs and activities of the Executive Branch.
APR	Agency Procurement Request.
ARPANET	DARPA network of scientific computers.
ASP	Aggregated Switch Procurement.
ATLAS	Abbreviated Test Language for All Systems (for ATE-Automated Test Equipment).
Authorization	In the legislative process programs, staffing and other routine activities must be approved by Oversight Committees before the Appropriations Committee will approve the money from the budget.
AUSA	Association of the U.S. Army.
AUTODIN	AUTOmatic DIgital Network of the Defense Communications System.
AUTOSEVOCOM	AUTOmatic SEcure VOice Communications Network
AUTOVON	AUTOmatic VOice Network of the Defense Communications System.
BA	Basic Agreement.
BAFO	Best And Final Offer.
Baselevel	Procurement, purchasing, and contracting at the military installation level.
BCA	Board of Contract Appeals.
Benchmark	Method of evaluating ability of a candidate computer system to meet user requirements.
Bid protest	Objection (in writing, before or after contract award) to some aspect of a solicitation by a valid bidder.
BM <sub>L</sub>	Bidders Mailing List—Qualified vendor information filed annually with federal agencies to receive automatically RFPs and RFQs in areas of claimed competence.
BOA	Basic Ordering Agreement.
B&P	Bid and Proposal—Vendor activities in response to solicitation/specific overhead allowance.
BPA	Blanked Purchase Agreement.
Budget	Federal Budget, proposed by the President and subject to Congressional review.
C <sup>2</sup>	Command and Control.
C <sup>3</sup>	Command, Control, and Communications.
C <sup>4</sup>	Command, Control, Communications, and Computers.
C <sup>3</sup> I	Command, Control, Communications, and Intelligence.
CAB	Contract Adjustment Board or Contract Appeals Board.
CADE	Computer-Aided Design and Engineering.

CADS	Computer-Assisted Display Systems.
CAIS	Computer-Assisted Instruction System.
CALS	Computer-Aided Automated Logistics System.
CAPS	Command Automation Procurement Systems.
CAS	Contract Administration Services or Cost Accounting Standards.
CASB	Cost Accounting Standards Board.
CASP	Computer-Assisted Search Planning.
CBD	<i>Commerce Business Daily</i> —U.S. Department of Commerce publication listing government contract opportunities and awards.
CBO	Congressional Budget Office.
CCEP	Commercial Comsec Endorsement Program.
CCDR	Contractor Cost Data Reporting.
CCN	Contract Change Notice.
CCPDS	Command Center Processing and Display Systems.
CCPO	Central Civilian Personnel Office.
CCTC	Command and Control Technical Center (JCS).
CDR	Critical Design Review.
CDRL	Contractor Data Requirement List.
CFE	Contractor-Furnished Equipment.
CFR	Code of Federal Regulations.
CICA	Competition in Contracting Act.
CIG	Computerized Interactive Graphics.
CIR	Cost Information Reports.
CM	Configuration Management.
CMI	Computer-Managed Instruction.
CNI	Communications, Navigation, and Identification.
CO	Contracting Office, Contract Offices, or Change Order.
COC	Certificate of Competency (administered by the Small Business Administration).
COCO	Contractor-Owned, Contractor-Operated.
CODSIA	COuncil of Defense and Space Industry Associations.
COMSTAT	Communications Satellite Corporation.
CONUS	CONTinental U. S.
COP	Capability Objective Package.
COTR	Contracting Officer's Technical Representative.
CP	Communications Processor.
CPAF	Cost-Plus-Award-Fee contract.
CPFF	Cost-Plus-Fixed-Fee contract.
CPIF	Cost-Plus-Incentive-Fee contract.
CPR	Cost Performance Reviews.
CPSR	Contractor Procurement System Review.
CR	Cost Reimbursement (Cost Plus contract).
CSA	Combat or Computer Systems Architecture.
C/SCSC	Cost/Schedule Control System Criteria (also called "C-Spec").
CWAS	Contractor Weighted Average Share in Cost Risk.

DAL	Data Accession List.
DAR	Defense Acquisition Regulations.
DARPA	Defense Advanced Research Projects Agency.
DAS	Data Acquisition System.
DBHS	Data Base Handling System.
DCA	Defense Communications Agency.
DCAA	Defense Contract Audit Agency.
DCAS	Defense Contract Administration Services.
DCASR	DCAS Region.
DCC	Digital Control Computer.
DCP	Development Concept Paper (DoD).
DCS	Defense Communications System.
DCTN	Defense Commercial Telecommunications Network.
DDA	Dynamic Demand Assessment (Delta Modulation).
DDC	Defense Documentation Center.
DDL	Digital Data Link—A segment of a communications network used for digital data transmission.
DDN	Defense Data Network.
DDS	Dynamic Diagnostics System.
DECCO	DEfense Commercial Communications Office.
DECEO	DEfense Communications Engineering Office.
D&F	Determination and Findings—Required documentation for approval of a negotiated procurement.
DIA	Defense Intelligence Agency.
DIF	Document Interchange Format—Navy-sponsored word processing standard.
DHHS	Department of Health and Human Services.
DIDS	Defense Integrated Data Systems
DISC	Defense Industrial Supply Center.
DLA	Defense Logistics Agency.
DMA	Defense Mapping Agency.
DNA	Defense Nuclear Agency.
DO	Delivery Order.
DOA	Department of Agriculture (also USDA).
DOC	Department of Commerce.
DOE	Department of Energy.
DOI	Department of Interior.
DOJ	Department of Justice.
DOS	Department of State.
DOT	Department of Transportation.
DPA	Delegation of Procurement Authority (granted by GSA under FPRs).
DPC	Defense Procurement Circular.
DQ	Definite Quantity Contract.
DQ/PL	Definite Quantity Price List Contract.
DR	Deficiency Report.
DSCS	Defense Satellite Communication System.
DSN	Defense Switched Network.
DSP	Defense Support Program (WWMCCS).
DSS	Defense Supply Service.

DTC	Design-To-Cost.
ECP	Engineering Change Proposal.
ED	Department of Education.
EEP	Equal Employment Opportunity.
EMC	Electro-Magnetic Compatibility.
EMCS	Energy Monitoring and Control System.
EO	Executive Order - Order issued by the President.
EOQ	Economic Ordering Quantity.
EPA	Economic Price Adjustment.
EPA	Environmental Protection Agency.
EPMR	Estimated Peak Monthly Requirement.
EPS	Emergency Procurement Service (GSA) or Emergency Power System.
EUC	End User Computing, especially in DoD.
FA	Formal Advertising.
FAC	Facility Contract.
FAR	Federal Acquisition Regulations.
FCA	Functional Configuration Audit.
FCC	Federal Communications Commission.
FCDC	Federal Contract Data Center.
FCRC	Federal Contract Research Center.
FDPC	Federal Data Processing Center.
FEDSIM	Federal (Computer) SIMulation Center (GSA).
FEMA	Federal Emergency Management Agency.
FFP	Firm Fixed-Price contract (also Lump Sum Contract).
FIPS	NIST Federal Information Processing Standard.
FIPS PUBS	FIPS Publications.
FIRMR	Federal Information Resource Management Regulations.
FMS	Foreign Military Sales.
FOC	Final Operating Capability.
FOIA	Freedom of Information Act.
FP	Fixed-Price contract.
FP-L/H	Fixed-Price—Labor/Hour contract.
FP-LOE	Fixed-Price—Level-Of-Effort contract.
FPMR	Federal Property Management Regulations.
FPR	Federal Procurement Regulations.
FSC	Federal Supply Classification.
FSG	Federal Supply Group.
FSN	Federal Supply Number.
FSS	Federal Supply Schedule or Federal Supply Service (GSA).
FSTS	Federal Secure Telecommunications System.
FT Fund	A revolving fund, designated as the Federal Telecommunications Fund, used by GSA to pay for GSA-provided common-user services, specifically including the current FTS and proposed FTS 2000 services.

FTPS	Federal Telecommunications Standards Program administered by NCS; standards are published by GSA.
FTS	Federal Telecommunications System.
FY	Fiscal Year.
FYDP	Five Year Defense Plan.
GAO	General Accounting Office.
GFE	Government-Furnished Equipment.
GFM	Government-Furnished Material.
GFY	Government Fiscal Year.
GIDEP	Government-Industry Data Exchange Program
GOCO	Government-Owned, Contractor-Operated.
GOGO	Government-Owned, Government-Operated.
GOSIP	Government Open Systems Interconnection Profile.
GPO	Government Printing Office.
GPS	Global Positioning System.
GRH	Gramm-Rudman-Hollings Act (1985), also called Gramm-Rudman Deficit Control.
GS	General Schedule.
GSA	General Services Administration.
GSBCA	General Services Administration Board of Contract Appeal.
HCFA	Health Care Financing Administration.
HHS	(Department of) Health and Human Services.
HPA	Head of Procuring Activity.
HSDP	High-Speed Data Processors.
HUD	(Department of) Housing and Urban Development.
ICA	Independent Cost Analysis.
ICAM	Integrated, Computer-Aided Manufacturing.
ICE	Independent Cost Estimate.
ICP	Inventory Control Point.
ICST	Institute for Computer Sciences and Technology, National Institute of Standards and Technology.
IDAMS	Image Display And Manipulation System.
IDEP	Interservice Data Exchange Program.
IDN	Integrated Data Network.
IFB	Invitation For Bids.
IOC	Initial Operating Capability.
IOI	Internal Operating Instructions.
IPS	Integrated Procurement System.
IQ	Indefinite Quantity Contract.
IR&D	Independent Research & Development.
IRM	Information Resource Manager.
IXS	Information Exchange System.
JOCIT	JOval Compiler Implementation Tool.
JSIPS	Joint Systems Integration Planning Staff.
JSOP	Joint Strategic Objectives Plan.

JSOR	Joint Service Operational Requirement.
JUMPS	Joint Uniform Military Pay System.
LC	Letter Contract.
LCC	Life Cycle Costing.
LCMP	Life Cycle Management Procedures (DD7920.1).
LCMS	Life Cycle Management System.
L-H	Labor-Hour Contract.
LOI	Letter of Interest.
LRPE	Long-Range Procurement Estimate.
LRIRP	Long-Range Information Resource Plan.
MAISRC	Major Automated Information Systems Review Council (DoD).
MANTECH	MANufacturing TECHnology.
MAPS	Multiple Address Processing System.
MAP/TOP	Manufacturing Automation Protocol/Technical and Office Protocol.
MASC	Multiple Award Schedule Contract.
MDA	Multiplexed Data Accumulator.
MENS	Mission Element Need Statement or Mission Essential Need Statement (see DD-5000.1 Major Systems Acquisition).
MILSCAP	MILitary Standard Contract Administration Procedures.
MIL SPEC	MILitary SPECification.
MIL STD	Military Standard.
MIPR	Military Interdepartmental Purchase Request.
MOD	Modification.
MOL	Maximum Ordering Limit (Federal Supply Service).
MPC	Military Procurement Code.
MYP	Multi Year Procurement.
NARDIC	Navy Research and Development Information Center.
NASA	National Aeronautics and Space Administration.
NCMA	National Contract Management Association.
NCS	National Communications System; responsible for setting U.S. Government standards administered by GSA; also holds primary responsibility for emergency communications planning.
NICRAD	Navy-Industry Cooperative Research and Development.
NIP	Notice of Intent to Purchase.
NIST	National Institute of Standards and Technology.
NMCS	National Military Command System.
NSA	National Security Agency.
NSEP	National Security and Emergency Preparedness.
NSF	National Science Foundation.
NSIA	National Security Industrial Association.

NTIA	National Telecommunications and Information Administration of the Department of Commerce; replaced the Office of Telecommunications Policy in 1970 as planner and coordinator for government communications programs; primarily responsible for radio.
NTIS	National Technical Information Service.
Obligation	Earmarking of specific funding for a contract from committed agency funds.
OCS	Office of Contract Settlement.
OFCC	Office of Federal Contract Compliance.
Off-site	Services to be provided near but not in government facilities.
OFMP	Office of Federal Management Policy (GSA).
OFPP	Office of Federal Procurement Policy.
OIRM	Office of Information Resources Management.
O&M	Operations & Maintenance.
OMB	Office of Management and Budget.
OM&R	Operations, Maintenance, and Readiness.
On-site	Services to be performed on a government installation or in a specified building.
OPM	Office of Procurement Management (GSA) or Office of Personnel Management.
Options	Sole-source additions to the base contract for services or goods to be exercised at the government's discretion.
OSHA	Occupational Safety and Health Act.
OSI	Open System Interconnect.
OSP	OffShore Procurement.
OTA	Office of Technology Assessment (Congress).
Out-Year	Proposed funding for fiscal years beyond the budget year (next fiscal year).
P-1	FY Defense Production Budget.
P3I	Pre-Planned Product Improvement (program in DoD).
PAR	Procurement Authorization Request or Procurement Action Report.
PAS	Pre-Award Survey.
PASS	Procurement Automated Source System.
PCO	Procurement Contracting Officer.
PDA	Principal Development Agency.
PDM	Program Decision Memorandum.
PDR	Preliminary Design Review.
PIR	Procurement Information Reporting.
PME	Performance Monitoring Equipment.
PMP	Purchase Mangement Plan.
PO	Purchase Order or Program Office.
POM	Program Objective Memorandum.
POSIX	Portable Open System Interconnect Exchange.

POTS	Purchase of Telephone Systems.
PPBS	Planning, Programming, Budgeting System.
PR	Purchase Request or Procurement Requisition.
PRA	Paperwork Reduction Act.
PS	Performance Specification - alternative to a Statement of Work, when work to be performed can be clearly specified.
QA	Quality Assurance.
QAO	Quality Assurance Office.
QMCS	Quality Monitoring and Control System (DoD software).
QMR	Qualitative Material Requirement (Army).
QPL	Qualified Products List.
QRC	Quick Reaction Capability.
QRI	Quick Reaction Inquiry.
R-1	FY Defense RDT&E Budget.
RAM	Reliability, Availability, and Maintainability.
RC	Requirements Contract.
R&D	Research and Development.
RDA	Research, Development, and Acquisition.
RDD	Required Delivery Date.
RD&E	Research, Development, and Engineering.
RDF	Rapid Deployment Force.
RDT&E	Research, Development, Test, and Engineering.
RFI	Request for Information.
RFP	Request for Proposal.
RFQ	Request for Quotation.
RFTP	Request for Technical Proposals (Two-Step).
ROC	Required Operational Capability.
ROI	Return on Investment.
RTAS	Real Time Analysis System.
RTDS	Real Time Display System.
SA	Supplemental Agreement.
SBA	Small Business Administration.
SB Set-Aside	Small Business Set-Aside contact opportunities with bidders limited to certified small businesses.
SCA	Service Contract Act (1964 as amended).
SCN	Specification Change Notice.
SDN	Secure Data Network.
SEC	Securities and Exchange Commission.
SE&I	Systems Engineering and Integration.
SETA	Systems Engineering/Technical Assistance.
SETS	Systems Engineering/Technical Support.
SIBAC	Simplified Intragovernmental Billing and Collection System.
SIMP	Systems Integration Master Plan.
SIOP	Single Integrated Operations Plan.
SNAP	Shipboard Nontactical ADP Program.

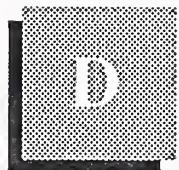
Sole Source	Contract award without competition.
Solicitation	Invitation to submit a bid.
SOR	Specific Operational Requirement.
SOW	Statement Of Work.
SSA	Source Selection Authority (DoD).
SSAC	Source Selection Advisory Council.
SSEB	Source Selection Evaluation Board.
SSO	Source Selection Official (NASA).
STINFO	Scientific and Technical INFOrmation Program—Air Force/NASA.
STU	Secure Telephone Unit.
SWO	Stop-Work Order.
Synopsis	Brief Description of contract opportunity in CBD after D & F and before release of solicitation.
TA/AS	Technical Assistance/Analysis Services.
TCP/IP	Transmission Control Protocol/Internet Protocol.
TEMPEST	Studies, inspections, and tests of unintentional electromagnetic radiation from computer, communication, command, and control equipment that may cause unauthorized disclosure of information; usually applied to DoD and security agency testing programs.
TILO	Technical and Industrial Liasion Office—Qualified Requirement Information Program—Army.
TM	Time and Materials contract.
TOA	Total Obligational Authority (Defense).
TOD	Technical Objective Document.
TR	Temporary Regulation (added to FPR, FAR).
TRACE	Total Risk Assessing Cost Estimate.
TRCO	Technical Representative of the Contracting Offices.
TREAS	Department of the Treasury.
TRP	Technical Resources Plan.
TSP	GSA's Teleprocessing Services Program.
TVA	Tennessee Valley Authority.
UCAS	Uniform Cost Accounting System.
USA	U.S. Army.
USAF	U.S. Air Force.
USCG	U.S. Coast Guard.
USMC	U.S. Marine Corps.
USN	U.S. Navy.
U.S.C.	United States Code.
USPS	United States Postal Service.
USRRB	United States Railroad Retirement Board.
VA	Department of Veterans Affairs.
VE	Value Engineering.
VHSIC	Very High Speed Integrated Circuits.
VIABLE	Vertical Installation Automation Base Line (Army).
VICI	Voice Input Code Identifier.

WBS	Work Breakdown Structure.
WGM	Weighted Guidelines Method.
WIN	WWMCCS Intercomputer Network.
WIS	WWMCCS Information Systems.
WITS	Washington Interagency Telecommunications System.
WS	Work Statement—Offerer's description of the work to be done (proposal or contract).
WWMCCS	World-Wide Military Command and Control System.
8(a)	Set-Aside Agency awards direct to Small Business Administration for direct placement with a socially/economically disadvantaged company.

**B****General and Industry Acronyms**

ADAPSO	Association of Data Processing Service Organization, now the Computer Software and Services Industry Association.
ADP	Automatic Data Processing.
ADPE	Automatic Data Processing Equipment.
ANSI	American National Standards Institute.
BOC	Bell Operating Company.
CAD	Computer-Aided Design.
CAM	Computer-Aided Manufacturing.
CBEMA	Computer and Business Equipment Manufacturers Association.
CCIA	Computers and Communications Industry Association.
CCITT	Comite Consultatif Internationale de Telegraphie et Telephonique; Committee of the International Telecommunication Union.
COBOL	COmmon Business-Oriented Language.
COS	Corporation for Open Systems.
CPU	Central Processing Unit.
DBMS	Data Base Management System.
DRAM	Dynamic Random Access Memory.
EIA	Electronic Industries Association.
EPROM	Erasable, Programmable, Read-Only Memory.
IEEE	Institute of Electrical and Electronics Engineers.
ISDN	Integrated Services Digital Networks.
ISO	International Organization for Standardization; voluntary international standards organization and member of CCITT.
ITU	International Telecommunication Union.

LSI	Large-Scale Integration.
MFJ	Modified Final Judgment.
PROM	Programmable, Read-Only Memory.
RBOC	Regional Bell Operating Company.
UNIX	AT&T Proprietary Operating System.
UPS	Uninterruptable Power Source.
VAR	Value-Added Reseller.
VLSI	Very Large Scale Integration.
WORM	Write-Once-Read-Many-Times.



## Policies, Regulations, and Standards

### A

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OMB Circulars	A-11 A-49 A-71  A-109 A-120 A-121  A-123 A-127 A-130 A-131	Preparation and Submission of Budget Estimates. Use of Management and Operating Contracts. Responsibilities for the Administration and Management of Automatic Data Processing Activities.  Major Systems Acquisitions. Guidelines for the Use of Consulting Services. Cost Accounting, Cost Recovery, and Integrated Sharing of Data Processing Facilities.  Internal Control Systems. Financial Management Systems. Management of Federal Information Resources. Value Engineering.
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### B

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GSA Publications	The FIRMR as published by GSA is the primary regulation for use by federal agencies in the management, acquisition, and use of both ADP and telecommunications information resources.
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### C

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DoD Directives	DD-5000.1 DD-5000.2 DD-5000.11  DD-5000.31  DD-5000.35 DD-5200.1 DD-5200.28	Major System Acquisitions. Major System Acquisition Process. DoD Data Elements and Data Codes Standardization Program.  Interim List of DoD-Approved, High-Order Languages.  Defense Acquisition Regulatory Systems. DoD Information Security Program. Security Requirements for Automatic Data Processing (ADP) Systems.
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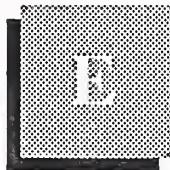
DD-5200.28-M	Manual of Techniques and Procedures for Implementing, Deactivating, Testing, and Evaluating Secure Resource Sharing ADP Systems.
DD-7920.2	Major Automated Information Systems Approval Process.
DD-7935	Automated Data Systems (ADS) Documentation.

**D**

Standards	ADCCP	Advanced Data Communications Control Procedures; ANSI Standard X3.66 of 1979; also NIST FIPS 71.
	CCITT G.711	International PCM standard.
	CCITT T.0	International standard for classification of facsimile apparatus for document transmission over telephone-type circuits.
	DEA-1	Proposed ISO standard for data encryption based on the NIST DES.
	EIA RS-170	Monochrome video standard.
	EIA RS-170A	Color video standard.
	EIA RS-464	EIA PBX standards.
	EIA RS-465	Standard for Group III facsimile.
	EIA RS-466	Facsimile standard; procedures for document transmission in the General Switched Telephone Network.
	EIA RS-232-C	EIA DCE to DTE interface standard using a 25-Pin connector; similar to CCITT V-24.
	EIA RS-449	New EIA standard DTE to DCE interface which replaces RS-232-C.
	FED-STD 1000	Proposed Federal Standard for adoption of the full OSI reference model.
	FED-STD 1026	Federal Data Encryption Standard (DES) adopted in 1983; also FIPS 46.
	FED-STD 1041	Equivalent to FIPS 100.
	FED-STD 1061	Group II Facsimile Standard (1981).
	FED-STD 1062	Federal standard for Group III facsimile; equivalent to EIA RS-465.
	FED-STD 1063	Federal facsimile standard; equivalent to EIA RS-466.
	FED-STDs 1005, 1005A-1008	Federal Standards for DCE Coding and Modulation.
	FIPS 46	NIST Data Encryption Standard (DES).
	FIPS 81	DES Modes of Operation.

FIPS 100	NIST Standard for packet-switched networks; subset of 1980 CCITT X.25.
FIPS 107	NIST Standard for local area networks, similar to IEEE 802.2 and 802.3.
FIPS 146	Government Open Systems Interconnection (OSI) Profile (GOSIP).
FIPS 151	NIST POSIX (Portable Operating System Interface for UNIX) standard.
IEEE 802.2	OSI-Compatible IEEE standard for data-link control in local area networks.
IEEE 802.3	Local area network standard similar to Ethernet.
IEEE 802.4	OSI-compatible standard for token-bus local area networks.
IEEE 802.5	Local area networks standard for token-ring networks.
IEEE P1003.1	POSIX standard, similar to FIPS 151.
MIL-STD-188-114C	Physical interface protocol similar to RS-232 and RS-449.
MIL-STD-1777	IP-Internet Protocol.
MIL-STD-1778	TCP - Transmission Control Protocol.
MIL-STD-1780	File Transfer Protocol.
MIL-STD-1781	Simple Mail Transfer Protocol (electronic mail).
MIL-STD-1782	TELNET - virtual terminal protocol.
MIL-STD-1815A	Ada Programming Language Standard.
SVID	UNIX System Interface Definition.
X.12	ANSI standard for Electronic Data Interchange
X.21	CCITT Standard for interface between DTE and DCE for synchronous operation on public data networks.
X.25	CCITT standard for interface between DTE and DCE for terminals operating in the packet mode on public data networks.
X.75	CCITT standard for links that interface different packet networks.
X.400	ISO Application-level standard for the Electronic transfer of messages (electronic mail).





## Agency Questionnaire

Interviewer Type:      Buyer       Telephone       Date   
                            User       On-Site   
                            Policy       Mail

Interviewer:

This questionnaire is directed towards the federal government's acquisition and use of geographic information systems, including software, hardware, and professional services.

Respondent Name: \_\_\_\_\_

Title: \_\_\_\_\_ Phone: \_\_\_\_\_

Department: \_\_\_\_\_

Agency: \_\_\_\_\_

Address: \_\_\_\_\_  
\_\_\_\_\_

Thank you for your patience in completing this questionnaire. Please return this questionnaire by \_\_\_\_\_ in the enclosed envelope. You will receive an executive summary of this report.

## Federal Geographic Information Systems Market

### Questionnaire Definitions

For the purposes of this survey, INPUT defines "Geographic Information Systems" and other products and services as follows:

*Geographic Information System* - a computerized data base management system for capture, storage, retrieval, analysis, and display of spatial (locationally defined) data.

*Microcomputer* - combines all of the CPU, memory, and peripheral functions of an 8-, 16-, or 32-bit computer on a chip in the form of:

- An integrated circuit package
- Plug-in boards with more memory and peripheral circuits
- Console including keyboard and interfacing connectors
- Personal computer with at least one external storage device directly addressable by the CPU
- An embedded computer which may take a number of shapes or configurations

*Midsize Computer* - Typically a 32- or 64-bit computer with extensive applications software and a number of peripherals in standalone or multiple-CPU configurations for business (administrative, personnel, and logistics) applications; also called a general-purpose computer. Specific systems in this category are IBM 93XX and AS/400 systems, all Digital VAX series systems, and some of the older systems from NCR and Data General are also included. Most large shared-logic, integrated office systems—such as those from Wang, Hewlett-Packard, and Groupe Bull—would also be considered midsize systems. This category does not include microcomputers (standalone, or shared), embedded systems, CAD/CAM systems, and workstations.

*Large Computer* - Presently centered around storage controllers but likely to become bus-oriented and to consist of multiple processors or parallel processors. Intended for structured mathematical and signal processing and typically used with general-purpose, VonNeumann-type processors for system control. Usually refers to traditional mainframes (such as IBM 30XX, Unisys 1100/XX, Honeywell DDPS88, or CDC Cyber series). Does not include supercomputers.

*Supercomputer* - High-powered processors with numerical processing throughput that is significantly greater than the fastest general-purpose computers, with capacities in the 100-500 million floating point operations per second (MFLOPS) range. Newer supercomputers, with burst modes over 500 MFLOPS, main storage size up to 10 million words, and on-line storage in the one-to-four gigabyte class, are labeled Class V to Class VII in agency long-range plans. Supercomputers fit in one of two categories:

- *Real Time* - Generally used for signal processing in military applications
- *Non-Real Time* - For scientific use in one of three configurations:
  - Parallel processor
  - Pipeline processor
  - Vector processor

*Software products* - This category comprises user purchases of applications and systems software packages for in-house computer systems. Included are expenditures for lease and purchase, and for work performed by the vendor to implement or maintain the package at the user's sites. Expenditures for work performed by organizations other than the package vendor are counted in the category of professional services. Fees for work related to education, consulting, and/or custom modification of software products are counted as professional services, provided such fees are charged separately from the price of the software product itself. Software products fall into two main categories, applications products and systems software products.

This questionnaire is divided into three parts:

- Part I addresses agency past buying trends and currently installed systems.
- Part II addresses agency buying intentions.
- Part III addresses agency opinions and perceptions of the federal market for Geographic Information Systems.

**I****Agency Environment****1. Do you currently use or plan to use Geographic Information Systems?**

Current	Future
Yes <input type="text"/>	Yes <input type="text"/>
No <input type="text"/>	No <input type="text"/>

(If no, please close the interview.)

**2. What GIS applications are used or are planned for use in your division and/or your branch?**

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**3. On what hardware platform does your GIS run?**

Supercomputer <input type="text"/>	Workstation <input type="text"/>
Mainframe <input type="text"/>	PC <input type="text"/>
Minicomputer <input type="text"/>	Microcomputer <input type="text"/>

**4. What brand of hardware does your agency use for its GIS?**

IBM <input type="text"/>	Hewlett-Packard <input type="text"/>
Intergraph <input type="text"/>	DEC <input type="text"/>
SUN <input type="text"/>	AT&T <input type="text"/>
Silicon Graphics <input type="text"/>	Other (please specify) <input type="text"/>
Stardent <input type="text"/>	
Tektronix <input type="text"/>	

**5. What type of operating system software does your GIS use?**

UNIX <input type="text"/>	VSE <input type="text"/>
MVS <input type="text"/>	MS/DOS <input type="text"/>
DOS/VSE <input type="text"/>	OS/2 <input type="text"/>
VM <input type="text"/>	Other (please specify) <input type="text"/>

**II****Agency Buying Intentions**

6. Does your agency expect to acquire GIS software in the FY 1991-1996 timeframe?

Yes \_\_\_\_\_ No \_\_\_\_\_

7. Would the GIS software acquisition be tied to a hardware purchase?

Yes \_\_\_\_\_ No \_\_\_\_\_ Don't know \_\_\_\_\_

8. How much will your agency spend on GIS by fiscal year (\$ millions)?

FY 1991	_____	FY 1994	_____
FY 1992	_____	FY 1995	_____
FY 1993	_____	FY 1996	_____

9. How will the GIS software be acquired (please check all that apply)?

Off-the-shelf software \_\_\_\_\_

Developed in-house \_\_\_\_\_

Custom contractor development \_\_\_\_\_

Combination (please specify) \_\_\_\_\_

Other (please specify) \_\_\_\_\_

**III****Agency Perceptions**

10. On a scale of 1 to 5, with 5 being most important and 1 being least important, please rate the following selection criteria:

Criteria	Rating				
Software Features	1	2	3	4	5
Vendor's Federal Experience	1	2	3	4	5
Ease of Implementation	1	2	3	4	5
Vendor's Support Reputation	1	2	3	4	5
Product Price	1	2	3	4	5
Equipment Reliability	1	2	3	4	5
Other	1	2	3	4	5

11 a. Do you have any opinion on the type of vendor or organization that appears most appropriate for providing computers to your agency?

Yes \_\_\_\_\_ No \_\_\_\_\_

b. If yes, please check all that apply.

Hardware vendors	_____	Professional services firms	_____
Software vendors	_____	Systems integrators	_____
Aerospace divisions	_____	Not-for-profit firms	_____
Other	_____	Suppliers	_____

12. On a scale of 1 to 5, with 5 being most important and 1 being least important, please rate the following acquisition methods.

Method	Rating				
Requirements Contracts	1	2	3	4	5
GSA Schedules	1	2	3	4	5
RFPs for Specific Purpose	1	2	3	4	5
Excess Equipment	1	2	3	4	5
Other ( )	1	2	3	4	5

13. Is your agency implementing GIS standards?

Yes \_\_\_\_\_ No \_\_\_\_\_

14. How are GIS standards being developed for your agency?

Agency in-house \_\_\_\_\_

Interagency groups \_\_\_\_\_

Using vendor-developed  
standards \_\_\_\_\_

Combination (specify) \_\_\_\_\_

15. What is the most expensive (in time or money) portion of developing a GIS?

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16. What can vendors do that best helps the federal government in developing and maintaining GIS?

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17. a. On a scale of 1 to 5, with 5 being most important and 1 being least important, please rate the importance of three-dimensional visualization in a GIS.

1      2      3      4      5

17. b. Why is visualization important? Or, why isn't it?

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18. What are technological features that you would like to see added to GIS in the future?

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19. In your opinion, which companies are market leaders in the federal GIS market?

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# About INPUT

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## Company Profile

INPUT provides planning information, analysis, and recommendations to managers and executives in the information services industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions.

Continuous-information advisory services, proprietary research/consulting, merger/acquisition assistance, and multiclient studies are provided to users and vendors of information systems and services (software products, processing and network services, systems management, and systems/software maintenance and support).

Many of INPUT's professional staff have more than 20 years' experience in their areas of specialization. Most have held management positions in large organizations, enabling them to supply practical solutions to complex business problems.

Formed as a privately held corporation in 1974, INPUT has become a leading international research and consulting firm. Clients include more than 100 of the world's largest and most technically advanced companies.

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## Staff Credentials

INPUT's staff have been selected for their broad background in a variety of functions, including planning, marketing, operations, and information processing. Many of INPUT's professional staff have held executive positions in some of the world's leading organizations, both as vendors and users of information services, in areas such as the following:

- Processing Services
- Professional Services
- Turnkey Systems
- Applications Software
- Field (customer) Service
- Banking and Finance
- Insurance
- Process Manufacturing
- Telecommunications
- Federal Government

Educational backgrounds include both technical and business specializations, and many INPUT staff hold advanced degrees.

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## U.S. and European Advisory Services

INPUT offers the following advisory services on an annual subscription basis.

### **1. Market Analysis Program—U.S.**

The Market Analysis Program provides up-to-date U.S. information services market analyses, five-year forecasts, trend analyses, vertical/cross-industry market reports, an on-site presentation, hotline inquiry service, and sound recommendations for action. It covers software products, turnkey systems, processing and network services, and professional services markets. It is designed to satisfy the planning and marketing requirements of current and potential information services vendors.

### **2. Market Analysis Program—Europe**

This program is designed to help vendors of software and services with their market planning. It examines the issues in the marketplace, from both a user and a vendor viewpoint. It provides detailed five-year market forecasts to help plan for future growth.

### **3. Vendor Analysis Program—U.S.**

A comprehensive reference service covering more than 400 U.S. information services vendor organizations, VAP is often used for competitive analysis and prescreening of acquisition and joint-venture candidates. Profiles on leading vendors are updated regularly, and hotline inquiry service is provided.

### **4. Vendor Analysis Program—Europe**

This is an invaluable service for gaining competitive information and for seeking targets for partnerships or acquisitions. The service provides profiles on some 450 European software and services vendors. A hotline enquiry service provides details on companies not covered by the profiles.

### **5. Electronic Data Interchange Program**

Focusing on what is fast becoming a major computer/communications market opportunity, this program keeps you well informed. Through monthly newsletters, timely news flashes, comprehensive studies, and telephone inquiry privileges, you will be informed and stay informed about the events and issues impacting this burgeoning market.

### **6. Network Services Program—Europe**

Network services is a fast-growing area of the software and services industry. This program is essential to vendors of EDI, electronic information services, and network products and services, keeping clients informed of the latest developments in the European marketplace.

**7. Systems Integration Program—U.S.**

Focus is on the fast-moving world of systems integration and the provision of complex information systems requiring vendor management and installation of multiple products and services. The program includes an annual market analysis of the U.S. systems integration market, SI vendor profiles and updates, topical market analysis reports, and an annual SI seminar.

**8. Systems Operations Program—U.S.**

This program focuses on the exciting resurgence of the market for outsourcing systems operations. It includes an annual market analysis report of the systems operations market, SO vendor profiles and updates, topical market analysis reports, and an annual SO seminar.

**9. Systems Management Program—Europe**

Systems integration and systems operations (facilities management) are key growth areas for the decade. This program examines these two areas and analyzes current market trends, user needs, and vendor offerings.

**10. Federal Information Systems and Services Program**

This program presents highly specific information on U.S. federal government procurement practices, identifies information services vendor opportunities, and provides guidance from INPUT's experienced Washington professionals to help clients maximize sales effectiveness in the federal government marketplace.

**11. State Information Systems and Services Program (proposed)**

This program presents extensive information on state government spending, procurement policies, identifies key contacts, opportunities, and provides guidance from INPUT's experienced professionals to help clients maximize sales opportunities in the state government marketplace.

**12. Information Systems Program**

ISP is designed for executives of large information systems organizations and provides crucial information for planning, procurement, and management decision making. This program is widely used by both user and vendor organizations.

**13. Customer Service Program—International**

This program provides customer service organization management with data and analyses needed for marketing, technical, financial, and organizational planning. The program pinpoints user perceptions of service received, presents vendor-by-vendor service comparisons, and analyzes and forecasts service markets for large systems, minicomputers, personal computer systems, and third-party maintenance. A monthly newsletter helps clients keep informed of the latest developments in the market.

**14. Customer Service Program—Europe**

Customer service is an expanding area. Companies are now expanding from hardware service to more software-related maintenance and professional services. This program helps vendors penetrate these new areas and provides guidelines for future market strategy. A monthly newsletter helps clients keep abreast of the latest developments in the market.

**15. Worldwide Information Services Market Forecasts**

In 1989 INPUT initiated this research study, which provides an international forecast for the information services market.

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**Customized Advisory Services** In addition to standard continuous-information programs, INPUT will work with you to develop and provide a customized advisory service that meets your unique requirements.

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**Acquisition Services** INPUT also offers acquisition services that are tailor-made for your requirements. INPUT's years of experience and data base of company information about information systems and services companies have helped many companies in their acquisition processes.

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**An Effective Combination** INPUT'S Executive Advisory Services are built on an effective combination of research-based studies, client meetings, informative conferences, and continuous client support. Each service is designed to deliver the information you need in the form most useful to you, the client. Executive Advisory Services are composed of *varied combinations of the following products and services:*

**Research-Based Studies**

Following a proven research methodology, INPUT conducts major research studies throughout each program year. Each year INPUT selects issues of concern to management. Topical reports are prepared and delivered throughout the calendar year.

**Information Service Industry Reports**

INPUT's Executive Advisory Services address specific issues, competitive environments, and user expenditures relative to:

Software Products
Processing Services
Network Services
Systems Integration
Systems Operations

Professional Services
Turnkey Systems
Small-Systems Service
Third-Party Maintenance
Large-Systems Service

### Industry-Specific Market Reports

Detailed analyses of market trends, forces driving the markets, problems, opportunities, and user expenditures are available for the following sectors:

Discrete Manufacturing	Insurance
Process Manufacturing	Medical
Transportation	Education
Utilities	Business Services
Telecommunications	Consumer Services
Retail Distribution	Federal Government
Wholesale Distribution	State and Local Government
Banking and Finance	Miscellaneous Industries

### Cross-Industry Market Report

A separate analysis covers the following cross-industry application areas:

Accounting	Office Systems
Education and Training	Planning and Analysis
Engineering and Scientific	Other Cross-Industry Sectors
Human Resources	

### Hotline: Client Inquiry Services

Inquiries are answered quickly and completely through use of INPUT's Client Hotline. Clients may call any INPUT office (San Francisco, New York, Washington D.C., London, or Paris) during business hours or they may call a voicemail service to place questions after hours. This effective Hotline service is the cornerstone of every INPUT Executive Advisory Service.

### The Information Center

One of the largest and most complete collections of information services industry data, the Information Center houses literally thousands of up-to-date files on vendors, industry markets, applications, current/emerging technologies, and more. Clients have complete access to the Information Center. In addition to the information contained in its files, the center maintains an 18-month inventory of over 130 major trade publications, vendor consultant manuals, economic data, government publications, and a variety of important industry documents.

### Access to INPUT Professional Staff

Direct access to INPUT's staff, many of whom have more than 20 years of experience in the information industry, provides you with continuous research and planning support. When you buy INPUT, you buy experience and knowledge.

### **Client Conference**

You can attend INPUT's Client Conference. This event addresses the status and future of the information services industry, the competitive environment, important industry trends potentially affecting your business, the impact of new technology and new service offerings, and more.

You will attend with top executives from many of the industry's leading, fastest-growing, and most successful vendor companies—and with top Information Systems (IS) managers from some of the world's most sophisticated user organizations.

### **On-Site Presentation by INPUT Executives**

Many of INPUT's programs offer an informative presentation at your site. Covering the year's research, this session is scheduled at the convenience of the client.

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## **Proprietary Research Service**

INPUT conducts proprietary research that meets the unique requirements of an individual client. INPUT's custom research is effectively used:

### **For Business Planning**

Planning for new products, planning for business startups, planning for expansion of an existing business or product line—each plan requires reliable information and analysis to support major decisions. INPUT's dedicated efforts and custom research expertise in business planning ensure comprehensive identification and analysis of the many factors affecting the final decision.

### **For Acquisition Planning**

Successful acquisition and divestiture of information services companies requires reliable information. Through constant contact with information services vendor organizations and continuous tracking of company size, growth, financials, and management "chemistry," INPUT can provide the valuable insight and analysis you need to select the most suitable candidates.

### **For the Total Acquisition Process**

INPUT has the credentials, the data base of company information, and—most importantly—the contacts to assist you with total acquisition and/or partnering relationship processes:

- Due Diligence
- Schedules and Introduction
- Criteria & Definitions
- Retainer and Fee-Based
- Active Search

### For Competitive Analysis

Knowing marketing and sales tactics, product capabilities, strategic objectives, competitive postures, and strengths and weaknesses of your competition is as critical as knowing your own. The career experience of INPUT's professionals—coupled with INPUT's collection and maintenance of current financial, strategic, tactical, and operational information about more than 400 active companies—uniquely qualifies INPUT to provide the best competitive information available today.

### For Market and Product Analysis

Developing new products and entering new markets involves considerable investment and risk. INPUT regularly conducts research for clients to identify product requirements, market dynamics, and market growth.

### More About INPUT...

- More than 5,000 organizations, worldwide, have charted business directions based on INPUT's research and analysis.
- Many clients invest more than \$50,000 each year to receive INPUT's recommendations and planning information.
- INPUT regularly conducts proprietary research for some of the largest companies in the world.
- INPUT has developed and maintains one of the most complete information industry libraries in the world (access is granted to all INPUT clients).
- INPUT clients control an estimated 70% of the total information industry market.
- INPUT analyses and forecasts are founded upon years of practical experience, knowledge of historical industry performance, continuous tracking of day-to-day industry events, knowledge of user and vendor plans, and business savvy.
- INPUT analysts accurately predicted the growth of the information services market—at a time when most research organizations deemed it a transient market. INPUT predicted the growth of the microcomputer market in 1980 and accurately forecasted its slowdown in 1984.

**For More Information . . .**

INPUT offers products and services that can improve productivity, and ultimately profit, in your firm. Please give us a call today. Our representatives will be happy to send you further information on INPUT services or to arrange a formal presentation at your offices.

For details on delivery schedules, client service entitlement, or Hotline support, simply call your nearest INPUT office. Our customer support group will be available to answer your questions.

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